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Front cover: Contractor Lui Weber undertaking abseil transect. Photo: Phil Box. From article "On the ropes for rare herbs - 2019 rope-access surveys in Limpinwood Nature Reserve".

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Australasian Plant Conservation is a forum for information exchange for all those involved in plant conservation: please use it to share your work with others. Articles, information snippets, details of new publications or research and diary dates are welcome. General articles on any plant conservation issue are most welcome.

The deadline for the **Summer 2019-2020** issue is 1 November. The special theme for the issue is **students working in threatened plant conservation**. If you are intending to submit an article or wish to discuss possibilities, please email the editor, Heidi Zimmer: **editor@anpc.asn.au**.

Authors are encouraged to submit images with articles or information. Please submit images in electronic format, resolution needs to be at least 300 dpi, at least the size that they are to be published, in tif, jpg or gif format. Guidelines for authors and an article template are at: **http://www.anpc.asn.au/apc**.

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From the editor

HEIDI ZIMMER

Welcome to spring (arguably the best month for plant enthusiasts), and to the spring issue of *Australasian Plant Conservation*. The theme of this issue is “Advances in Australian plant conservation”, and we are putting the spotlight on advances in plant conservation resulting from the NSW Saving our Species (SoS) program. The SoS program has been allocated $100 million in funding from the NSW Government from 2016-2021 with the aim of securing more threatened plants and animals in the wild in NSW. The SoS program is also an organisational member of the Australian Network for Plant Conservation. The articles in this issue cover a handful of the great projects happening under SoS. Let’s dive in.

In the first article, Justin Mallee brings us a story of discovery and adventure, featuring hike in and rope access surveys of the rare herbs *Euphrasia bella* and *Gaultheria viridicarpa* subsp. *merinoensis* in Limpinwood Nature Reserve. You’ll have to read the full article to learn what they found. We continue on the theme of rope access, with Jakki Trenbath’s article on a campaign to raise awareness of five species which occur on cliff habitat in the Blue Mountains.

Next is an article by Aaron Mulcahy *et al*. which investigates the best course of management for the Endangered shrub *Prostanthera askania,* which occurs largely on private land – community engagement will be key to conservation success. This is followed by an article where Mark Cameron and Paul Segal introduce us to the little-known *Solanum sulphreum*, another Endangered shrub. Work to conserve this species includes fencing, weeding, seed banking and, importantly, work to raise awareness of this species and its requirements, which also has significant occurrences on private land – it appears that recruitment is stimulated by disturbance, but the species is intolerant of competition.

We move then to rainforest, and the Endangered tree *Daphnandra johnsonii*. Jedda Lemmon reports on a breakthrough in our understanding of why this species produces ‘pseudo-fruit’ which contain no seeds.

Staying with rainforest, Luke Foster and Aaron Mulcahy lay out the challenges of hyrbidisation in conservation management, with the story of *Syzygium paniculatum* and *Syzygium oleosum*.

The subject of the next two articles is translocation, a recent favourite topic in *APC*. Tim Sutton provides an introduction to the new translocation policy in NSW – how the policy deals with climate change, establishment of *ex situ* populations, mitigation translocations, and how the policy fits in with the ANPC translocation guidelines – essential reading for anyone planning a translocation in NSW. Kylie Coutts-McClelland then presents us with a translocation case study of *Zieria baeuerlenii,* which covers issues including genetic diversity, fencing and an unexpected bushfire treatment.

Finally, we have an article by Peter Ardill which takes a long-term view of conservation, giving us examples from history of successful restoration. ASBP news takes us way south, with seed collecting in high-winds and near freezing temperatures on Macquarie Island. We round out the issue with a member profile, book review, ANPC news and research round up. Thank you to all our contributors!

P.S. During the production of this issue the Office of Environment and Heritage (NSW Government), which is mentioned in several articles, was subsumed under the Department of Planning, Industry and Environment (NSW Government).

P.P.S. Readers may also remember that when I’m not editing APC, I work for the NSW Government ... now in the Department of Planning, Industry and Environment, which is the same department which looks after the SoS program ... which is how I knew about all these great plant conservation projects!

On the ropes for rare herbs – 2019 rope-access surveys in Limpinwood Nature Reserve

JUSTIN MALLEE

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Background

New South Wales National Parks and Wildlife Service (NPWS) in collaboration with the Conservation and Regional Delivery team and Science Division of the Office of Environment and Heritage and specialist contractors have been chasing the very rare Mt Merino Waxberry (*Gaultheria viridicarpa* subsp. *merinoensis*) and Pretty Eyebright (*Euphrasia bella*). Both species were only known from one cliff in Limpinwood Nature Reserve (NR).

Study location

Limpinwood NR and the adjoining Lamington National Park (NP) are two world heritage listed reserves. They are also internationally recognised biodiversity hotspots with a large number of endemic species including *Euphrasia bella*, Mt Merino Everlasting Daisy (*Coronidium telfordii*), *Leucopogon* sp. Lamington, *Pittosporum oreillyanum*, *Parsonsia tenuis* and Lamington Myrtle (*Uromyrtus lamingtonensis*) to name a few.

The reserves meet along the precipitous watershed – and state border – on the eastern end of the McPherson Range. This section of the McPherson Range is known as the Wollumbin Erosion Caldera and is a remnant of the 23-million-year-old shield volcano. In its former life, the volcano had three major eruptions creating layered geological strata consisting of Beechmont Basalts below 600 m altitude, Binna Burra Rhyolites from 600-800 m and Hobwee Basalts from 900-1200 m.

The unique qualities of these geological strata and their location in the landscape were key to this study. Both of the target species – *Gaultheria viridicarpa* subsp. *merinoensis* and *Euphrasia bella* – only inhabit the Hobwee Basalts. More specifically, both were only known from one south-facing cliff above 1100 m. The single, and small, populations of these species were considered threats to their long-term survival. To try and better understand their rarity, exploratory surveys in the vast and rugged Limpinwood NR were planned for 2019.

Site selection and methods

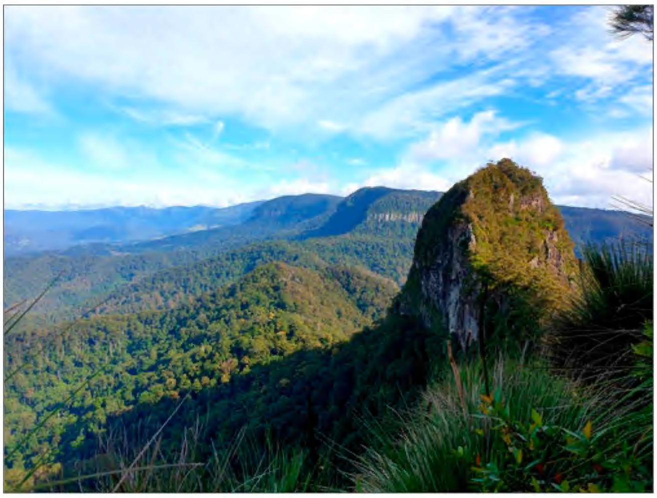

Figure 1. Wollumbin Erosion Caldera. Looking west from Mt Cougal towards Limpinwood Nature Reserve. Photo: Justin Mallee

The combination of challenging site access and limited resources meant that site selection was critical to the study. To take the guesswork out of the site selection, Justin Mallee from NPWS worked with Rebecca Gibson from Science Division to construct and run a habitat model in ARC GIS. A review of *E. bella* records revealed four known historical sites. These included a *Euphrasia* known from the Border Ranges NP to the south west of Limpinwood NR that is now considered to be a distinct taxon *E.* sp. aff. *bella*; a site near Mt Ballow in south east Queensland that is now identified as a form of *E. collina*; a record from west Limpinwood from 1942 that is no longer present; and the site in east Limpinwood surveyed as part of the Saving our Species program in 2017. Of these four sites, only the population in east Limpinwood was considered to be *E. bella*.

A similar review of *Gaultheria viridicarpa* subsp. *merinoensis* records was undertaken. This was considerably easier as the subspecies has been recorded at only one site.

With only one confirmed site for each species, the known ecological criteria to incorporate in the model were limited. The criteria used were designed to find similar habitats to those at the known locations, being south aspect with potential cliff-slopes greater than 70 degrees, on Hobwee Basalts and an altitude exceeding 1100 m. Three sites that met these criteria were identified as potential habitat by the GIS analysis.

With the desktop assessments finished, special rope-access permits approved by Queensland Parks and

Wildlife Service (not normally a permissible activity) and land managers consulted, the survey team was engaged. NPWS teamed up with Montane Ecological Solutions and High Places Rope Access to undertake field surveys at the end of January and start of February 2019. The plan was for five days of surveying, including ~40 km of hiking with remote field gear and rope access equipment. One day's survey effort was planned for each of the predicted sites, leaving the remaining two days for getting to and from basecamp (~20 km return).

Abseil transects were conducted at each site by setting up dual safety ropes anchored to larger trees or boulders using rope protectors to reduce impacts on epiphytes. Short vertical transects (<30 m) were surveyed in multiple locations at each site. Where the target species were located or open shrubless habitat was present, longer transects were surveyed up to 60 m down the cliff-face. The location, number, size and reproductive status of all target flora species or other species of note were recorded. General notes on the habitat type and dominant species were recorded along with locations and types of any threats. Data were recorded directly into GIS point shapefiles using ESRI ArcPad 10 on a Personal Digital Assistant with built-in GPS.

What did we find?

After many days of hiking with heavy packs and many hours of dangling off ropes, the study team made the significant discovery of two new populations of *E. bella* in western Limpinwood NR, bringing the total to three known populations of this very rare species.

These new records represent the first collection of *Euphrasia* in the western section of the reserve in over 80 years. Before this study there was only one other record of this species, from 1942, by D. A. Smith who described the plant as "small delicate trailing herb on bank of track flowers very showy, deep blue". Collected from "Track Edge between Echo Point and Main Border Track". Extensive searches confirmed that the species was no longer present near Echo Point.

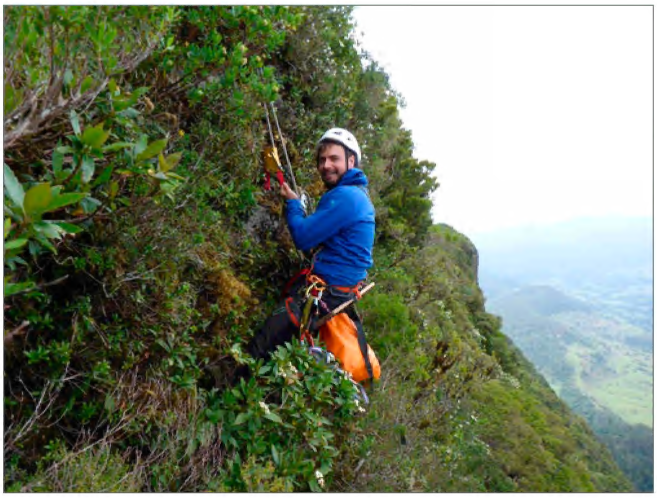

Figure 2. Contractor Lui Weber undertaking abseil transect. Photo: Phil Box

Interestingly, the two new populations differ morphologically from the previously known population. Key differences include upper and lower tepal size ratios and alignment, flower and fruit petiole lengths, leaf width, number of teeth per leaf, leaf internode lengths and shape and colour of the bee-guiding spot. The flowering time and habit also differ.

Differences in the morphology of the three populations of *E. bella* in Limpinwood NR indicate they may have been isolated for some time. Although geographically close, each population is separated by steep mountainous terrain that potentially creates barriers to pollen movement. Photographs of the *E. bella* plants at the three sites in Limpinwood NR and *E.* sp. aff. *bella* from the Border Ranges site were reviewed by W. R. Barker (South Australian Herbarium), Australia's foremost *Euphrasia* expert. He noted that there are other examples of morphological variation between geographically close *Euphrasia* populations, including those on the Tasman Peninsula in Tasmania.

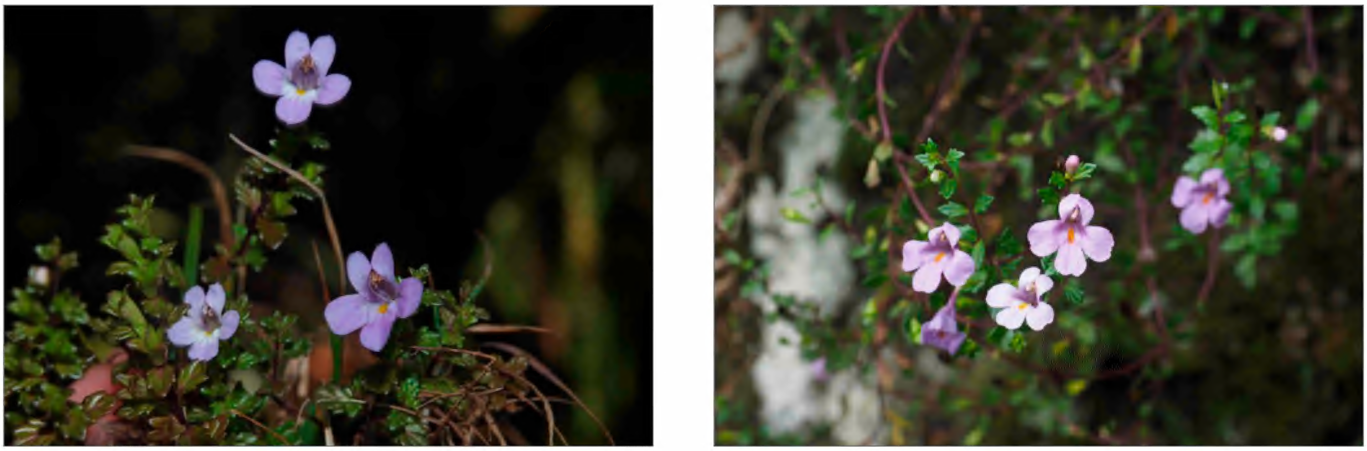

Figure 3. *Euphrasia bella* from two sites showing differences in flower morphology. Photos: Lui Weber

Where to from here?

This study has increased our understanding of the ecology of and threats to *E. bella*. A major outcome is the reduced risk of extinction associated with stochastic events like storms or fire. Whereas knowledge of new populations is a good thing it also increases the area to be managed and the responsibility to monitor and manage threats, such as weed encroachment. Another threat that needs to be carefully considered is the impact of monitoring these sites. To reduce impacts of surveys, surveys are only to be conducted every 3 years, using best practice hygiene protocols and only under strict permits from Queensland Parks and Wildlife.

Unfortunately, no new locations of *Gaultheria viridicarpa* subsp. *merinoensis* were located. There are, however, many unexplored cliff-lines throughout the surrounding reserves that may be home to this elusive plant. Future surveys will continue with the collaborative approach and aim to monitor the known populations of the two target species and, where funding allows, will expand the search area to other likely sites in the vast unexplored wilderness areas of the Wollumbin Caldera cliffs.

Treat every plant as if it's the last: Saving our Species' Cliffhanging 5 campaign

JAKKI TRENBATH

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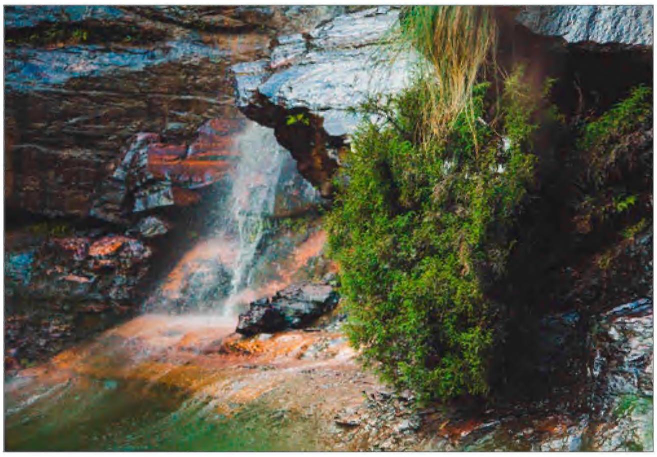
Five species of plants cling to existence around the cliffs of the Upper Blue Mountains in New South Wales. They are found nowhere else in the world, and some are survivors from the time of the Gondwanan supercontinent, when dinosaurs walked the earth over 200 million years ago. One of the threats they face is trampling by others who also love hanging around on cliffs—i.e. rock-climbers.

Saving our Species (SoS) is a NSW Government program which aims to maximise the number of threatened species that can survive securely in the wild and control key threats facing threatened biodiversity. Projects to help a thousand plant, animal and fungi species have been funded over a five-year period (2016–2021). Community engagement and behaviour change is also being used as part of the tool kit to assist these species.

In early 2018 staff from SoS approached Monique Forestier, a Blue Mountains local well-known in the rock-climbing community. They asked her if she would be willing to be the face of a campaign promoting the five plants to fellow rock-climbers. The campaign would focus on asking them to be more careful of vegetation around clifftops. Because she spends so much time on the cliffs herself, she felt an affinity for the small, hardy plants that share her favourite environment and was very willing to help.

Threats

Because each species' population is so small, they are vulnerable to random events leading to extinction. The species identified as the focus for the behaviour-change program included Dwarf Mountain Pine (*Pherosphaera fitzgeraldii*), *Euphrasia bowdeniae*, *Epacris hamiltonii*, *Leionema lachnaeoides,* and Fletcher's Drumsticks *(Isopogon fletcheri)*. These species are restricted to areas on and around cliffs, particularly to wet areas near waterfalls and sandstone seeps. Total known populations for the species range from ~750 for *Pherosphaera fitzgeraldii* to ~60 for *Euphrasia bowdeniae.* All five plants occur mostly in the national park, with smaller pockets on council and private land.

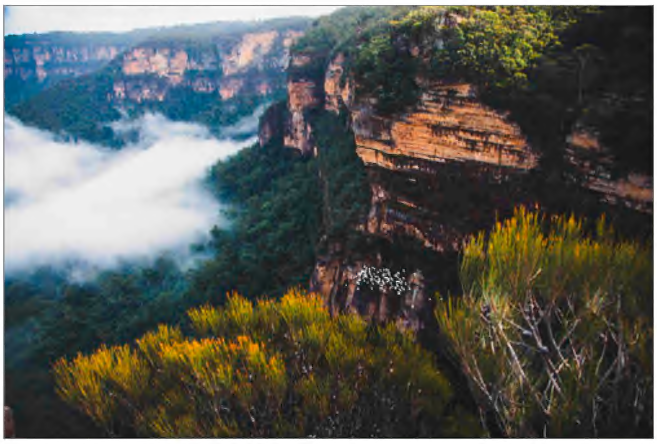


Dwarf Mountain Pine *Pherosphaera fitzgeraldii* growing in the spray zone of a water fall near Wentworth Falls. Photo: Daniel Parsons.

Because of their cliff-hanging location, the plants are extremely vulnerable to bushfire as well as to polluted water running down from the nearby townships.

Recreational activities are also a major threat to the plants, which can easily be trampled by rock-climbers, abseilers and bushwalkers. The small populations are often clumped, meaning a single incident can result in a large loss relative to the total population. Many of the plants are also inconspicuous, particularly when not flowering, leading to greater potential for damage.

One of only about 60 remaining individuals of *Euphrasia bowdenii*. Photo: Vera Wong



Blue Mountain cliff habitat for the *Euphrasia bowdenii.* Photo: Daniel Parsons)

***Isopogon fletcheri* in the foreground near Govett's Leap, Blackheath. Photo: Jakki Trenbath.**

Changing behaviour

A behaviour-change initiative was designed, focusing on a series of five 60 second videos called "The Cliffhanging 5". A sixth video featuring an introduction from Monique Forestier was also created. The videos had a high production value, and featured local rangers and ecologists sharing the stories behind each species. Because the species are inconspicuous, the primary message was not that the general public should be able to recognise each plant, but rather that people needed to be careful of all cliff-dwelling vegetation in case it was one of the five threatened species. A key message from the program was "Treat every plant as if it's the last."

The videos were launched at the Women's Adventure Film Festival in the Blue Mountains and then released as paid posts on the NSW National Parks and Wildlife (NPWS) Facebook page, targeting people in the Blue Mountains and Sydney who had an interest in rock-climbing and outdoor recreation. The links to the videos were sent to any rock-climbing, canyoning and bushwalking groups around Sydney and the Blue Mountains. An accompanying brochure was created and about 500 were distributed to rock-climbing and adventure focused businesses around the Blue Mountains.

Outcomes

Although no quantitative review of behaviour change has been undertaken, qualitative indicators suggest the campaign was a success. Facebook recorded 6551 views of at least 75% of each video, 3160 "likes", "loves" and "wows", 230 comments, and 1340 shares. This indicated that the target audience were receiving the videos and receptive to the message. Many people expressed amazement about the plants, commenting on their uniqueness and agreeing about the importance of protecting them.

Proof that there was an increased awareness within the rock-climbing community became apparent when a rock-climber posted on Facebook that he thought he had seen some *Isopogon fletcheri* near an established climbing route. It turned out that this was a previously unknown subpopulation. NPWS and climbers then got together and re-routed the climb to avoid possible damage to the plants. The newly-recorded population adds to the genetic stock and geographical range available to protect the species—which is great news for the species and Saving our Species staff.

The question remains about whether other rock-climbers and other users will change their behaviour as a result of the campaign, but this will only become apparent over the next couple of years.

Link to compilation video: https://www.environment.nsw.gov.au/news/the-cliffhanging-five.

Developing a conservation project for *Prostanthera askania*: an adaptive approach

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Introduction

Prostanthera askania B.J. Conn (Tranquility Mintbush) is an erect shrub with a spreading or scrambling habit typically growing 1-2.5 m high (Figure 1). The species is endemic to the NSW Central Coast region and has a very restricted geographic range. All 11 known populations occur over an area of less than 20 km, with 10 of these occurring in the Gosford-Ourimbah locality. *Prostanthera askania* primarily inhabits wet sclerophyll forest and warm temperate rainforest communities, and most often occurs in areas with increased light availability including canopy gaps, forest margins and adjacent to tracks (Figure 2) (DEC 2006). The species is listed as Endangered under the NSW *Biodiversity and Conservation Act 2016* and the *Environment Protection and Biodiversity Conservation Act 1999*.

The last comprehensive review of *P. askania* population data (DEC 2006) revealed the species is poorly represented in conservation reserves, with only one small outlier population more recently found in Bouddi National Park (Beckers 2009). The review also found the two largest known populations of *P. askania* that collectively constitute an estimated 90% of all known individuals occur on private freehold land. Smaller populations are known from Council reserves, Crown Land and State Forest. Habitat of *P. askania* has been historically cleared for urban development and subsequently degraded by threats associated with fragmentation and land use changes. Continued urban development pressure, weed invasion and altered fire regimes are likely to place many *P. askania* populations at high risk of extinction over the coming decades in the absence of threat abatement and recovery actions.

Prostanthera askania has been assigned to the *site-managed stream* under the NSW Government's *Saving our Species* (SoS) program. The SoS program aims to secure threatened species in the wild in NSW for 100 years. We outline the key challenges in developing the *P. askania* SoS project, actions undertaken to date, and future directions of the project to assist in securing the long-term survival of this species.

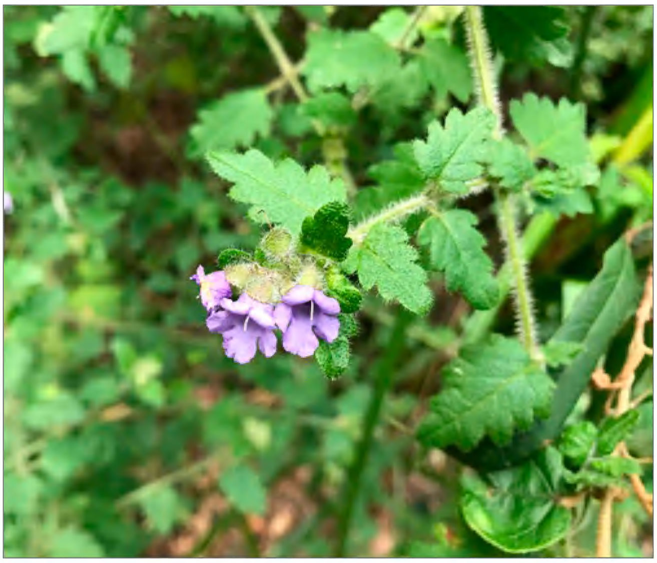

Figure 1. ***Prostanthera askania*** **with flowers. Photo: Aaron Mulcahy**

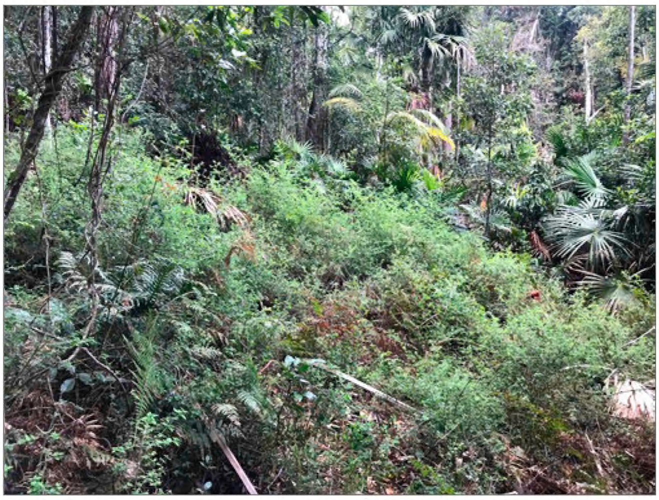

Figure 2. ***Prostanthera askania*** **patch in canopy gap of forest dominated by** ***Eucalyptus saligna*** **(Sydney Blue Gum) and** ***Syncarpia glomulifera*** **(Turpentine). Photo: Aaron Mulcahy**

Site selection and stakeholder engagement

The occurrence of key *P. askania* populations across a variety of unsecure land tenure is one of the key threats to the species. The main challenge for the project at its inception was to identify and engage key landholders whose collective participation in the program could substantially contribute to managing and protecting the species. Following consultation with a diverse range of stakeholders, a total of four SoS management sites were selected for inclusion in the program: Strickland State Forest, Bouddi National Park, Central Coast Council land at Niagara Park, and private land at Ourimbah. These sites encompass five of the 11 known *P. askania* populations, including two of the four largest populations.

Surveys

At commencement of the project, some *P. askania* population information was available for the sites from previous surveys by DEC in 2003; this survey data formed the basis of population estimates in the *Prostanthera askania* Recovery Plan (DEC 2006). As the extent of these previous surveys within the SoS sites was limited, systematic targeted surveys for *P. askania* were undertaken in 2017 and 2018. Data on population size and demographics, and the extent and severity of threats to the populations were collected. The searches were primarily focused in vegetation communities most frequently associated with the species (i.e. moist eucalypt forest and rainforest).

Population size

A total of 1,648 *P. askania* plants were found across the four SoS management sites (Table 1). The largest population recorded was 902 plants on the Ourimbah site, exceeding the previous population estimate (150-300 plants) and extent at this site (DEC 2006). Across the four sites, 462 to 752 (39% to 83%) additional *P. askania* individuals were recorded compared to the previous population estimates. These differences between the 2006 and 2017 population estimates highlight the need for systematic targeted searches to determine the full extent of populations.

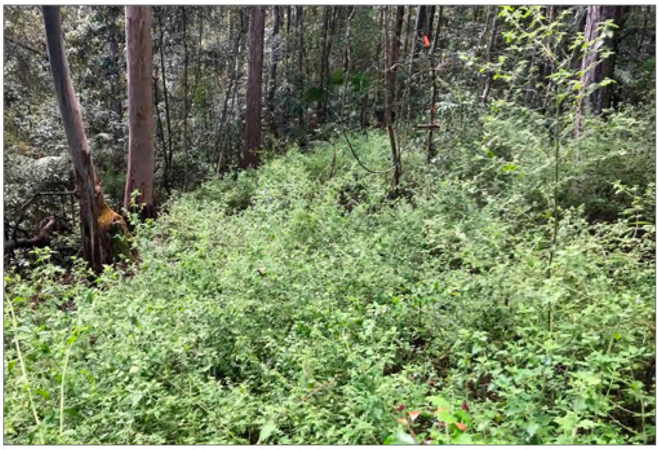

Figure 3. Large patch of ***Prostanthera askania*****. Photo: Aaron Mulcahy**

Threat assessment

The most immediate threat to a number of *P. askania* subpopulations at the SoS sites is weed invasion. Lantana (*Lantana camara*) was the most abundant and highest threat weed at the sites and has the potential to outcompete *P. askania* as it occupies similar habitats (i.e. canopy gaps and margins of wet eucalypt forests; Figure 4). The extent and density of high threat weeds were mapped in proximity to *P. askania* populations during the surveys. Altered fire regimes is also a major potential threat to the species (discussed below).

Table 1. Current and previous ***Prostanthera askania*** **population estimates for each SoS site**

SoS management site	Population estimates (2017-2018 surveys)	Previous population estimates (DEC 2006; Beckers 2009)
Strickland State Forest	252	96
Bouddi National Park	337	500
Niagara Park (Central Coast Council land)	157	150-290
Ourimbah (private land)	902	150-300
Total	**1,648**	**896-1,186**

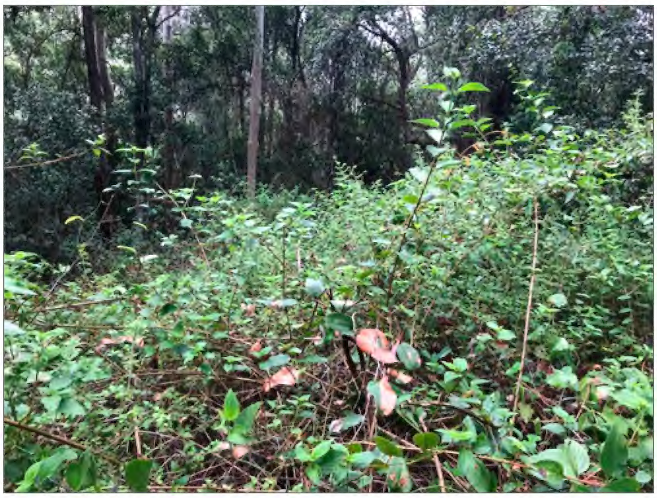

Figure 4. ***Prostanthera askania*** **intermixed with** ***Lantana camara*****.**
Photo: Aaron Mulcahy

Management actions and monitoring

Weed management

Weed management was conducted at the SoS sites in 2018, focusing on the removal and treatment of weeds directly impacting *P. askania* plants and in the immediate vicinity of populations (i.e. 50 m buffer). Approximately 18.6 ha of high threat weeds (predominately Lantana and Small-leaved Privet (*Ligustrum sinense*)) have been treated to date, assisting the recovery of 250 affected *P. askania* across the SoS sites. A monitoring program was also established concurrently to evaluate the effectiveness of weed control on the recovery of affected *P. askania* populations. Follow-up weed control was undertaken in early 2019 with subsequent monitoring planned for spring 2019.

It is anticipated that weed control will aid the growth and survival of affected *P. askania* plants at the SoS sites. However, it is unlikely that weed control alone will stimulate sufficient recruitment to assist the recovery of *P. askania* populations beyond their current restricted occurrences. While there is still limited knowledge on the species' biology and ecology, field observations and research conducted to date suggest periodic disturbance is required to increase germination and seedling establishment.

Fire and soil disturbance trial

Prostanthera askania is reported to be a fire-sensitive species that produces seed with high levels of dormancy. Anecdotal evidence indicates that *P. askania* plants will often senesce under low light conditions, and the long-term absence of disturbance may be detrimental to population persistence (DEC 2006). Previous lab-based seed germination studies (Tierney 2006) and field observations (DEC 2006) suggest that low intensity fire may be optimal for promoting recruitment in *P. askania* populations by breaking seed dormancy. Recent population modelling by Tierney (2018) also suggests that direct weed removal in combination with fire would be substantially more effective in facilitating large recruitment events. Examination of fire history records for the SoS sites indicate most subpopulations of *P. askania* have not been burnt for at least 30 years.

Observations during the 2017-2018 surveys also suggest germination of *P. askania* seed can be triggered by soil disturbance. A large seedling population was discovered at Strickland State Forest within a large canopy gap created during a storm event, with many seedlings clustered around fallen tree bases and other soil disturbance areas (Figure 5). Research on seed dormancy of other *Prostanthera* species also indicates that the genus may respond to multiple dormancy breaking and germination cues (Ainsley and Jones 2010).

An *in situ* experimental trial has been designed as part of this SoS project to evaluate the effects of fire and soil disturbance on *P. askania* seed germination and seedling establishment. This field trial is a critical step in validating the effectiveness and suitability of implementing fire and soil disturbance actions to promote *P. askania* recruitment under natural conditions. The outcomes of the trial will be used to improve management of *P. askania* populations across the SoS sites. The trial is currently underway at one of the SoS sites, with the results expected in early 2020. Stay tuned to future editions for the trial results!

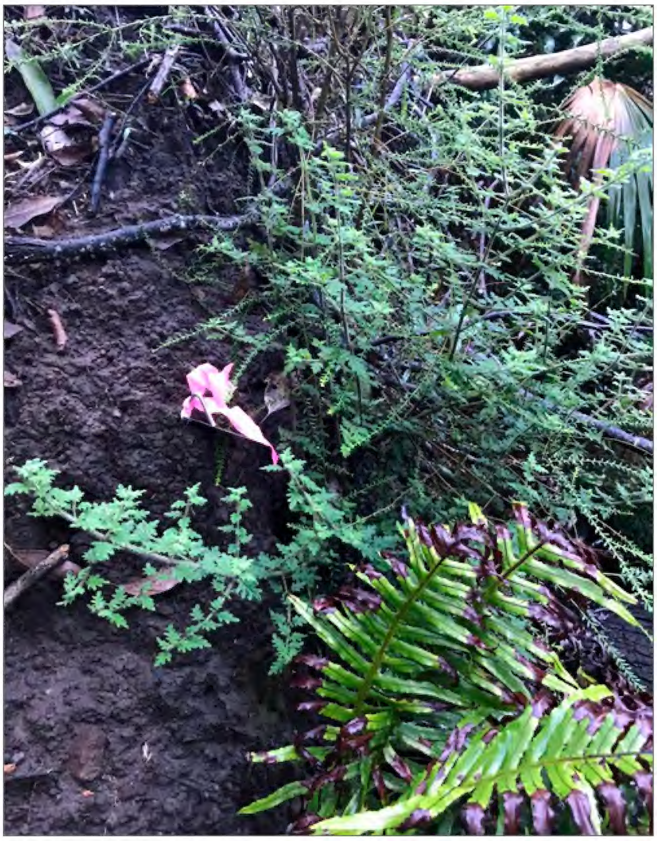

Figure 5. ***Prostanthera askania*** **growing from fallen tree base.**
Photo: Aaron Mulcahy

Future directions

In addition to on-ground management, community engagement will be an ongoing focus of the *P. askania* program. The participation of multiple landholders has also proven to be a major strength of the *P. askania* SoS project to date by providing a range of opportunities to collaborate and learn more about the species and how best to manage it. It is hoped that these future community engagement initiatives will provide a catalyst for further collaborative efforts among key stakeholders to achieve this shared objective.

Acknowledgements

We would like to thank all of our *Prostanthera askania* SoS project partners: Patty Collin and Karen Clarke (Forest of Tranquility); Chris Slade and Mark Drury (Forestry Corporation of NSW); Alf Britton (Friends of Strickland State Forest) Rochelle Lawson and Larry Melican (Central Coast Council), and Vicki Elliot (NSW National Parks and Wildlife Service, Hunter Central Coast Branch).

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Introducing the Manning Yellow Solanum (*Solanum sulphureum*)

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Background

The Manning Yellow Solanum (*Solanum sulphureum*) is a recently described species with a newly debuted common name, known from only six separate locations within the Taree and Wingham areas of the mid north coast of New South Wales. This limited distribution is one factor contributing towards its listing as an Endangered species under both the NSW *Biodiversity Conservation Act 2016* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* in October 2015 and November 2016 respectively. Author Paul Segal submitted both threatened species nominations in early 2104 with assistance from Dr Tony Bean and Dr Lachlan Copeland.

Where did I come from?

Worldwide, the *Solanaceae* plant family contains about 90 genera with over 2600 species, the majority of which reside in Central and South America (ABRS 1982). Australia contains 23 of those genera, equating to approximately 200 species nationally. The Manning Yellow Solanum exists within the *Solanum* genus and was officially described as a new species in 2009 by Dr Tony Bean from the QLD Herbarium. Its discovery came about after Tony examined an unidentified *Solanum* specimen collected from 1986 at Killibakh Creek near Taree and concluded that it was native (Bean 2009). In December 2004 Tony searched for three days and eventually discovered live plants matching the specimen from two locations south west of Wingham; Mt George and Burrell Creek. Following these sightings, *S. sulphureum* was regarded as a separate species from within a *Solanum brownii* group defined in earlier work by Tony (Bean 2004). Formal recognition came later in 2009 when the official description was published in *Telopea* (Bean 2009).

Species information

Characteristics of the Manning Yellow Solanum can be found in Bean (2009) and Bell, Rockley, and Llewellyn (2019) along with the unique traits that distinguish it from other *Solanum* species. These traits include:

- Entire ovate adult leaves (2.1-2.8 times longer than wide).
- Dense to very dense star-shaped (stellate) hairs with stalks up to 1.2 mm long.

- Few flowers at the top of the flower stalk (cymose inflorescence).
- Outer leaf-like structures (sepals) with few or no prickles and star-shaped (stellate) hairs 0.6-0.7 mm diameter.
- Spherical yellow fruits 14-19 mm diameter.
- Spines on juvenile leaves and stems.
- No spines on new leaves and stems of mature plants.
- Flower buds are spineless and grow from mature stems.

The images in Figure 1 further highlight some of the distinguishing traits. This species has similarities to the noxious weed Tropical Soda Apple (*Solanum varium*) and as a result land managers and agriculturalists may misidentify the species.

The Manning Yellow Solanum can grow to approximately three metres high with a lifespan of four to five years. This species has similar disturbance response traits to other *Solanum* species with germination cues that include fire, mechanical soil disturbance, reduced canopy competition (tree falls), heavy rainfall, agricultural landuse management practices and extended rainfall over about 28 days. Yet, germination does not happen every year and there are many other ecological unknowns with this species.

In terms of habitat, requirements are not prescriptive but known populations primarily occur in moist rainforest and wet sclerophyll forest. Bean (2009) describes the habitat as sunny breaks in rainforest, pasturelands with rainforest regrowth or eucalypt forest with a rainforest understorey. Soils are shallow or deep loams and clay-loams under 200 m altitude. However, there are exceptions where plants have been discovered on dry ridges where disturbance including clearing or cattle grazing has occurred.

In terms of life cycle and natural predation, species expert and author Paul Segal has recorded a plethora of observations and photos since early 2014, some of which are listed below.

- In the Sassafras Conservation Area (SCA) germination cues include newly disturbed soil with either filtered sunlight or clear sky-view, gaps in dense canopy (1-3 tree crowns), 25°C temperatures and 25-28 days of continuous rain that can be as low as 1 to 2 mm per day. Germination inhibitors include more than 3 days of dry weather and soil that is not constantly wet or moist.
- The species is very sensitive to herbicide and is affected by off-target spray. For example, where surrounding plants of other species show small signs of herbicide effects, an adjacent Manning Yellow Solanum can be a fatality within 2 to 3 days.
- Cattle will eat the spineless part of the plants but can be protected from herbivory when they grow within clumps of other plants or colonising weeds such as lantana.
- No native herbivores are known to feed on the plants at any stage of growth.

Current status

The current aerial Extent of Occurrence for the Manning Yellow Solanum is shown below in Figure 2. Yellow points represent historic or existing site records that are currently stored in the NSW Government BioNet database.

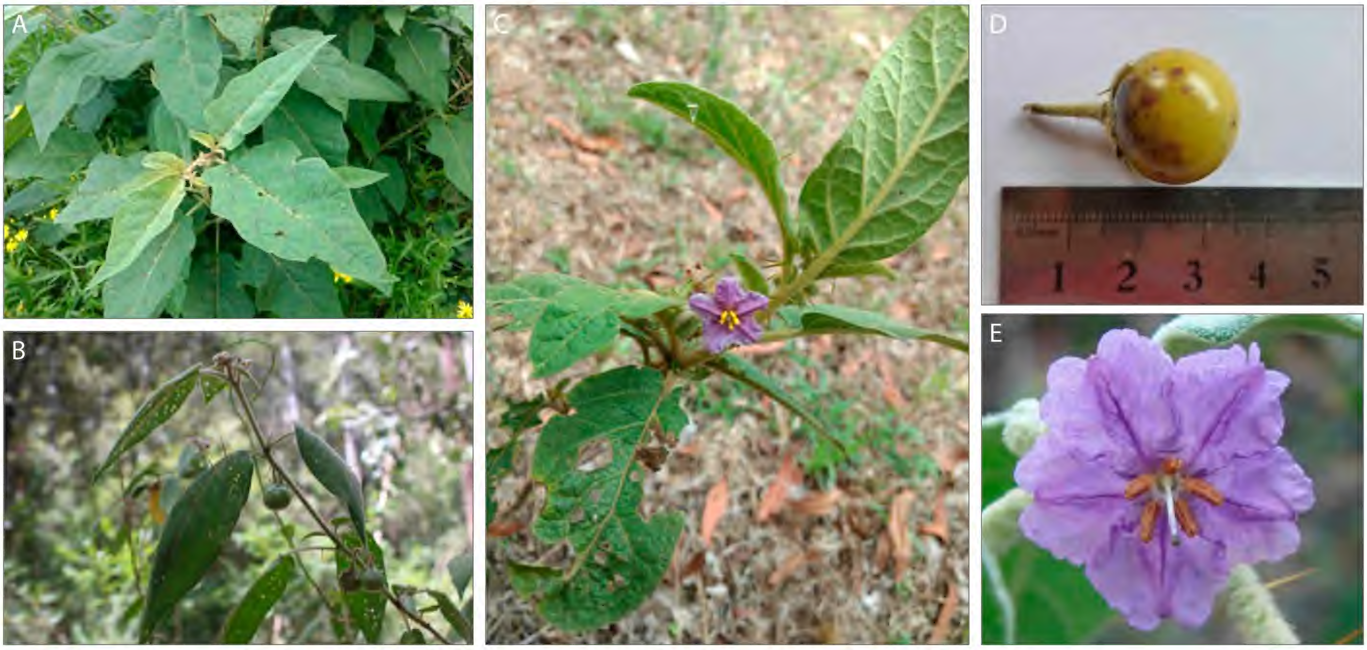

Figure 1. Images of Solanum sulphureum. (a) adult plant; (b) immature green fruit; (c) juvenile with leaf damage; (d) fruit and (e) flower. Photos (a), (b) and (c): Mark Cameron, DPIE; (d) and (e): Paul Segal

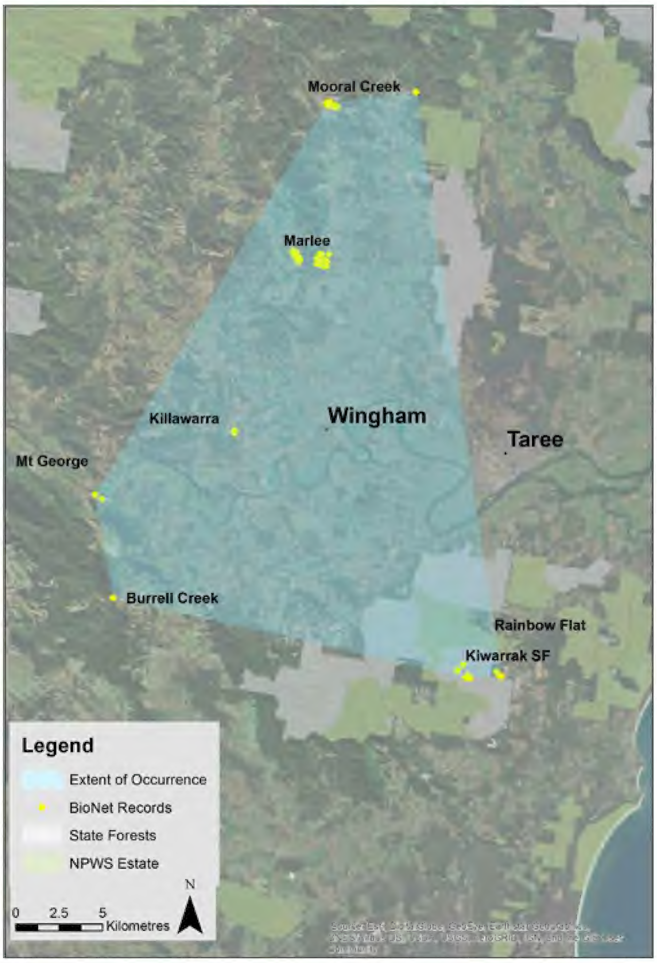

Figure 2. Manning Yellow Solanum. Extent of Occurrence based on historic and current NSW BioNet database records.

The tenure of the locations consist of State Forest, freehold and one Conservation Agreement area at Mooral Creek which is the only place the species has formal protection.

Since July 2016, this species has been prioritised for investment under the NSW Government's *Saving Our Species* (SoS) program. That investment includes the funding of monitoring and management actions at four key management sites in order to achieve the SoS program's goal of securing threatened species in the wild for the next 100 years. As of March 2019, the total population estimate was in the range of 400-500 individuals however the subsequent loss of some individuals has been observed due to drought conditions and frost.

Research

The *Saving our Species* program has enabled further research into the ecology of the species and funded on-site management actions to reduce the known threats to the species survival. As examples, sites have been fenced to prevent cattle incursions, weeding programs introduced and landholder education to raise awareness of the species existence and requirements.

Monitoring plots have been established at Mooral Creek to assess germination after weeding and a range of disturbance trials are planned for Kiwarrak State Forest. The Kiwarrak State Forest trials are to be conducted on areas where a population appeared after harvesting operations that were conducted from February 2013 to February 2014. The first plants were first observed in August 2013 and the population continued until February 2017. Plants are no longer present due to competition of resources by forest regeneration so the planned trials will answer the question regarding the presence of a seed bank in that location.

Prior to the establishment of the *Saving our Species* program in 2016, the Australian PlantBank at Mount Annan did not possess any seeds of *S. sulphureum*. In May 2017, at least 60 plants were discovered at a Rainbow Flat property (south of Taree) where germination resulted from shrub clearing for grazing. Later in February 2018, seedbank officers from the Australian PlantBank together with the property owner collected approximately 24,000 seeds to establish the first ever *ex situ* seed bank of the species. However, the most intriguing ecological question remains unsolved and that is the persistence or life span of the seed bank in the wild. With anecdotal suggestions of a seed life of 20-40 years, an experiment that could answer such a long-term question in a short timeframe is a research priority.

Future conservation

So, if you see a Manning Yellow Solanum you know you have encountered a special species that is somewhat cryptic and unique to the Manning Valley area. We are hopeful that public awareness will play a major role in identifying further populations and promote the need for private land conservation beyond the SoS program so that the species may persist for generations to come.

Acknowledgements

Many thanks go to Wendy Bushell of Mid Coast Council who was instrumental in identifying the plants and providing the locations that have since become SoS sites.

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New discoveries for the endangered Illawarra Socketwood (*Daphnandra johnsonii*, Atherospermataceae)

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The New South Wales Government's *Saving our Species* program (SoS) aims to secure threatened flora in the wild through targeted conservation projects. Monitoring and conservation efforts for the Illawarra Socketwood (*Daphnandra johnsonii*), listed as Endangered on both the NSW *Biodiversity Conservation Act 2016* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999,* has resulted in multiple gains in our knowledge of this species. The Illawarra Socketwood Recovery Plan (DEC 2005) highlighted that limited seed development and factors responsible for the production of 'pseudo fruit' are essential aspects of the species' biology requiring investigation. We are pleased to report that we are now able to explain the cause of deformed fruit in this species. Increased field survey and monitoring has also led to the discovery of many new populations, and we have commenced genetic work to better understand the extent of clonality in this species.

The species

- Perennial medium-sized rainforest tree.
- Endemic to the Illawarra region of NSW.
- Clonal species, reproducing primarily by coppicing and suckering.

Threatening processes

- Habitat loss and fragmentation.
- Low levels of viable seed.
- Suspected low levels of genetic diversity and high levels of clonality.
- Invasive weed species.
- Browsing and stem damage from livestock and feral deer.

Habitat and distribution

Illawarra Socketwood grows on rocky hillsides and gullies of the Illawarra escarpment and coastal lowlands in Illawarra Subtropical Rainforest habitat, and occasionally in warm temperate rainforest (DEC 2005). It is known between Toolijooa in the south to Avondale in the north, with a disjunct northern population at Scarborough (Figure 1).

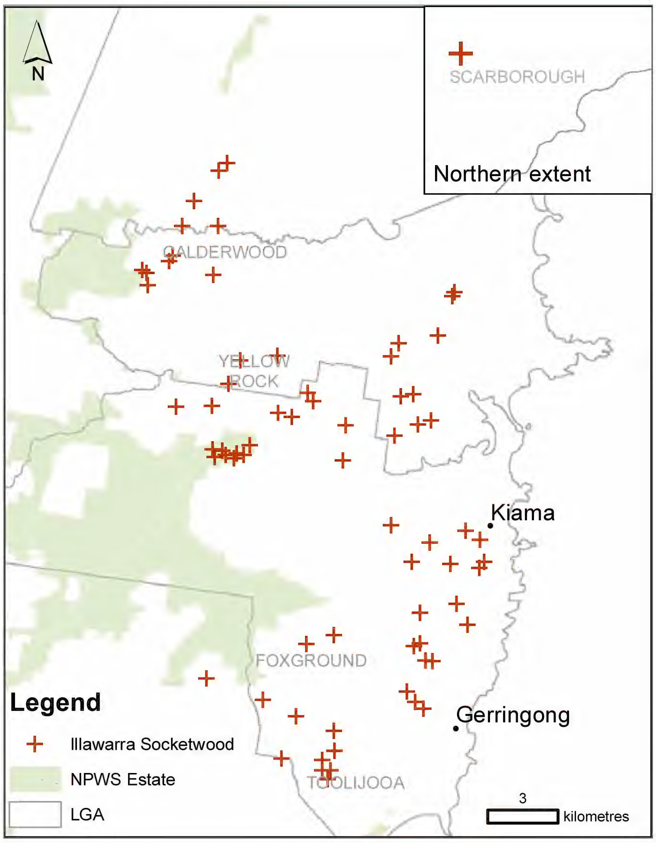

Figure 1. Distribution of *Daphnandra johnsonii*. The inset shows the disjunct northern population at Scarborough.

A new discovery, the Illawarra Socketwood gall midge

Most Illawarra Socketwood populations are known to produce only 'pseudo-fruit', a globose malformed fruiting receptacle containing no seed (DEC 2005). The reason for this has remained unexplained. Low seed germination rates are also reported for this species by both the Australian Botanic Garden Mount Annan and Wollongong Botanic Gardens.

To pursue this knowledge gap, fruit were collected from two populations in the Kiama Local Government Area in April 2017, with assistance from Wollongong Botanic Gardens. The malformed fruit were split and inspected under a microscope, revealing multiple larvae within (Figure 2).

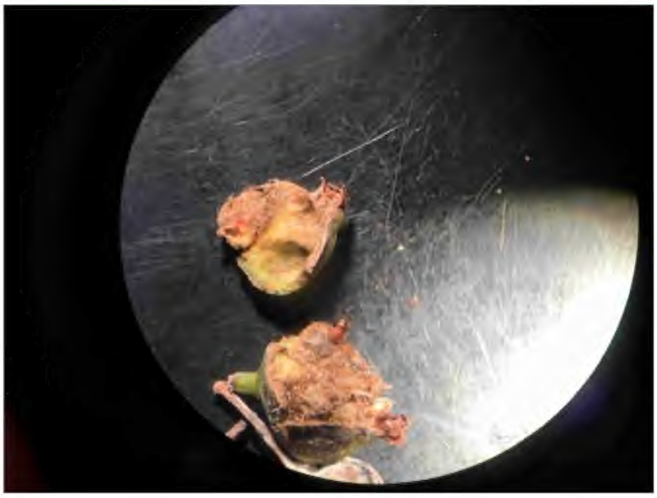

Figure 2. Dissected fruit showing emergent pupal cases. Photo: Jedda Lemmon

The malformed fruit were collected and bagged and within ten days of collection larvae pupated and emerged as adults.

The insects were reared with support from the University of Wollongong and identified by Dr Peter Kolesik as an undescribed species of the Dipteran family Cecidomyiidae, commonly known as gall midges. This is the first gall midge described for a host plant within the Atherospermataceae family (Southern Sassafrases). The insect has been recently described and named after its host plant as *Asphondylia daphnandrae (*Kolesik *et al.* 2019).

Gall inducing insects are known for their tight associations with one, or a few, closely related host species (Blanche 2012). It is therefore likely that *A. daphnandrae* feeds exclusively on Illawarra Socketwood or related congeners. *Daphnandra apatela* has also been observed to bear galled fruit (Foreman and Whiffin 2007). Further investigation is needed to affirm whether it is also a host plant for *A. daphnandrae*.

Fruit infested with *A. daphnandrae* are readily observed around March to April by their globose galls, which contain no viable seed (Figure 3). The larvae are legless, orangey yellow in colour, and 1.5–2 mm in length (Kolesik *et al*. 2019). Non-infested fruit produce elongated fruiting receptacles and are more likely to contain developed seed (Figure 4).

The impact of the Gall Midge on Illawarra Socketwood

Fewer than 2% of the Australian vascular plant genera are reported to have native gall-inducing insects (Blanche 2012). Galls can form on leaf or stem tissue, but when flowers are targeted, seed production can be substantially limited, potentially influencing the structure of ecological communities (Blanche 2012).

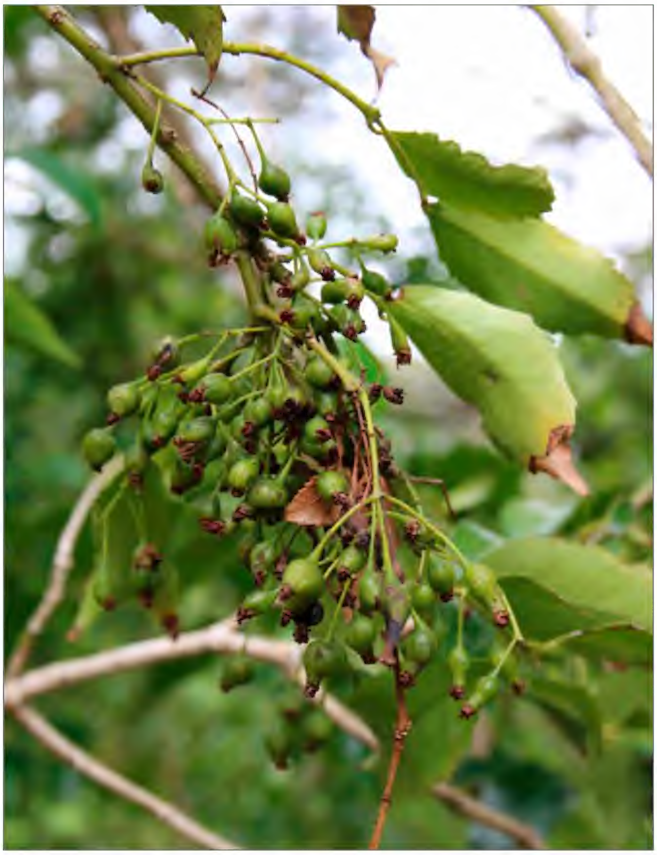

Figure 3. Galled fruit infested with *Asphondylia daphnandrae* larvae. Photo: Jedda Lemmon

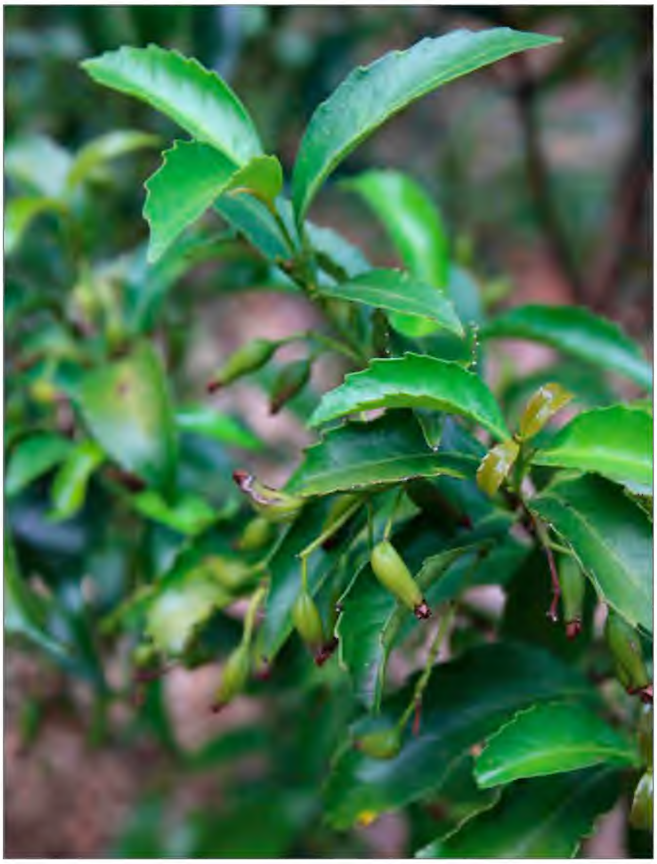

Figure 4. Healthy non-galled fruits. Photo: Jedda Lemmon

Sexual reproduction of Illawarra Socketwood appears to be limited by *A. daphnandrae*. The larvae feed on the inside of deformed fruits and no seed develops inside (Kolesik *et al*. 2019). It is also suspected that low levels of genetic diversity within Illawarra Socketwood populations contributes to low levels of seed production. Understanding the relative influence of these factors is a focus for future work.

At present, only one population is known that does not appear to contain the midge. Further work is needed to confirm the extent of the midge across all Illawarra Socketwood populations and the extent to which it limits seed production. Some trees may be partially affected by the midge allowing for normal fruit to develop, although this appears to be the minority of cases observed to date.

Given that *Daphnandra johnsonii* is the only one of five species of *Daphanndra* listed as threatened, the contribution of the gall midge to its status and limited distribution is an interesting question.

Genetic work and population estimates

Illawarra Socketwood relies predominantly on clonal reproduction from suckers and coppicing stems. Given this, we are unable to easily quantify the number of genetically distinct individuals (genets) that comprise populations. In this context we arbitrarily define populations as plants separated by at least 200 m (DEC, 2005). Seventy-two populations are currently known, including eight new populations recorded since 2016 under the SoS project.

SoS is currently funding genetic work with the Royal Botanic Gardens Sydney to improve our understanding of the extent of clones within and between Socketwood populations. To date we have collected samples from 183 plants across 24 wild populations. We suspect that some populations contain just one genetic individual. If this were to be true for most populations, the total population may be less than 200 plants. We look forward to receiving these analysis results soon.

Future work

Exploring methods and outcome for some level of control of the gall midge would be a worthy future pursuit in the conservation efforts for Illawarra Socketwood. If methods can be developed to limit the impact of the gall midge, we can explore whether natural seed production can be enhanced.

The outcomes of the genetic work will provide enhanced understanding of levels of clonality within populations and enable us to make informed estimates of population size. If the level of clonality is very high, then investigation of options to improve genetic diversity may be required, potentially in concert with gall midge control.

Acknowledgements and key stakeholders

We acknowledge funding provided by the NSW *Saving Our Species* program. We thank all landholders, contractors, partners and volunteers who have contributed to our recent work on Illawarra Socketwood. Most notably we thank Dr Peter Kolesik, and Prof. James Wallman, Nathan Butterworth and Tracey Gibson of University of Wollongong for assistance with describing the Gall Midge. James Beatty and Debby Downes from Wollongong Botanic Garden for assistance with seed collection. Maurizio Rossetto and Trevor Wilson of Royal Botanic Gardens Sydney for collaboration on our current genetic work under the Restore and Renew program. We also thank Richard Scarborough, Carl Glaister, Dr Kevin Mills and Marcus Burgess for contributing knowledge on new populations of Illawarra Socketwood.

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Possible hybridisation between *Syzygium paniculatum* and *Syzygium oleosum* presents issues for identification, conservation and management of a threatened species

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Introduction

Recent surveys have identified possible hybridisation between the rare rainforest tree, *Syzygium paniculatum* and a sympatric congener, *Syzygium oleosum*. This taxonomic uncertainty raises issues for decision makers, particularly as *S. paniculatum* is a listed threatened species. We outline the key implications of these findings and the steps that are being taken to resolve this uncertainty.

Editor's note: A sympatric congener is a species from the same genus which occurs in the same geographic area.

Species information: *Syzygium paniculatum*

Syzygium paniculatum (Magenta Lilly Pilly) is a small- to medium-sized rainforest tree typically growing up to a height of 15 m (Figure 1). Plants produce white flowers clustered in the upper parts of branches which develop into magenta-coloured fruit (Figure 2) crowned by persistent fleshy inflexed sepals. Each fruit contains a solitary seed which is polyembryonic, consisting of one to nine embryos (Wilson 2002, OEH 2012). The species primarily occurs in littoral and subtropical rainforest on sand (including coastal sand dunes and deposits), and in subtropical rainforest on sandstone-derived alluvium (OEH 2012). *Syzygium paniculatum* is sparsely distributed along coastal areas of NSW between Conjola National Park in the south to Upper Lansdowne in the north, with a north-south geographic extent of approximately 400 km. The current estimated total population size of *S. paniculatum* is 1,200 individuals, consisting of five disjunct metapopulations (OEH 2012). This species is listed as Endangered under the NSW *Biodiversity Conservation Act 2016* (BC Act) and Vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

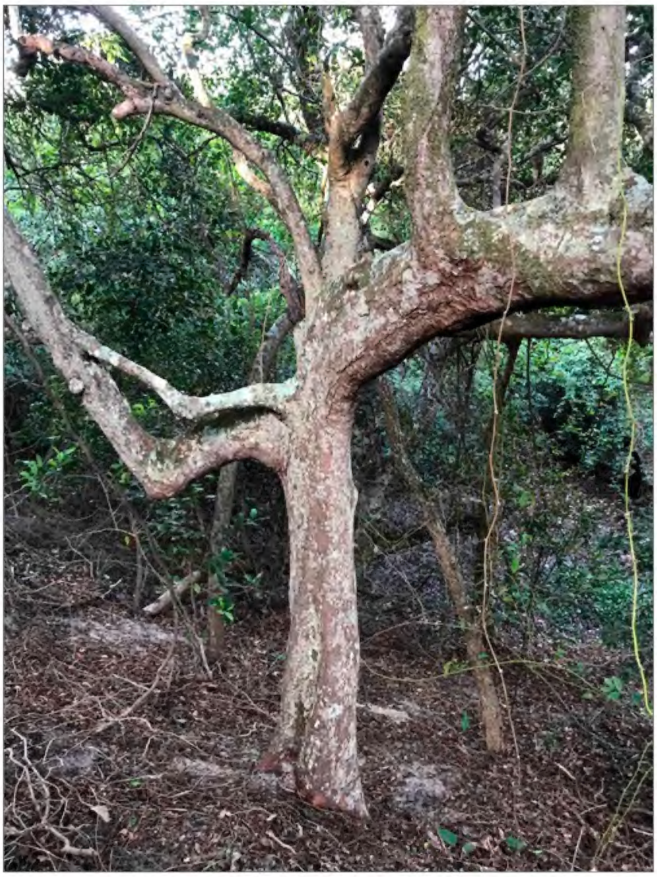

Figure 1. *Syzygium paniculatum* tree, Myall Lakes National Park. Photo: Aaron Mulcahy

Syzygium paniculatum is superficially similar to several other Lilly Pilly species, including *Syzygium oleosum* (Blue Lilly Pilly) which occurs sympatrically with *S. paniculatum* across its natural range. Key features used to distinguish *S. paniculatum* and *S. oleosum* include size and density of leaf oil glands, fruit morphology and colour, and seed anatomy (OEH 2012; PlantNET 2019). *Syzygium paniculatum* can be readily distinguished from these other similar species when fruiting, as it is the only known Australian species of the genus to produce seeds that regularly have multiple embryos (Hyland 1983; Thurlby *et al*. 2012).

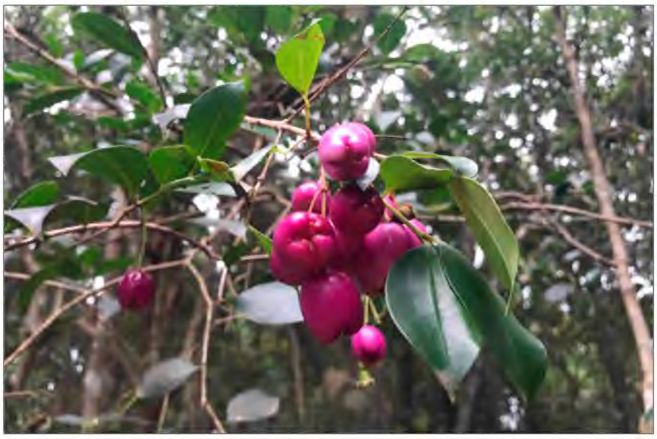

Figure 2. ***Syzygium paniculatum*** **fruit. Photo: Aaron Mulcahy**

Atypical *Syzygium paniculatum*

In 2016, plants displaying intermediate characteristics of *S. paniculatum* and *S. oleosum* were first reported by National Parks and Wildlife Service (NPWS) staff in the Great Lakes area on the NSW Mid North Coast. Targeted surveys for *S. paniculatum* in 2018 under the NSW Government's Saving our Species (SoS) program identified several additional populations with plants showing traits of both species. The fruit and seed of these plants are consistent with *S. paniculatum* (i.e., magenta fruit, polyembryonic seed). However, the leaf traits are either intermediate or more consistent with *S. oleosum*, with higher leaf length:breadth ratio, larger oil glands, and higher oil gland density than typical *S. paniculatum* (Figure 3). Current advice from the National Herbarium of NSW is that these specimens are considered an atypical form of *S. paniculatum* (P. Wilson 2016, *pers. comm.*).

In addition to the atypical *S. paniculatum*, many *S. oleosum* plants observed during the surveys had polyembryonic seed (Figure 4) but were otherwise consistent with the current taxonomic description of the species. Polyembryonic *Syzygium oleosum* were observed in Booti Booti NP, Myall Lakes NP (Mid North Coast), Wyrrabalong NP, and Wamberal Lagoon Nature Reserve (Central Coast). A higher proportion of polyembryonic *S. oleosum* was seen on the Mid North Coast than the Central Coast. Notably, polyembryonic *S. oleosum* on both the Mid North Coast and Central Coast did not appear to produce polyembryonic seed exclusively, with a mixture of poly- and mono-embryonic seeds typically present on each plant.

So, what does this mean?

At a taxonomic level, our findings suggest there may be genetic exchange occurring between *S. paniculatum* and *S. oleosum* populations in the Mid North Coast and Central Coast regions. A study by Thurlby *et al.* (2012) found *S. paniculatum* has relatively low genetic diversity across its range (based on 11 subpopulations sampled, one from the Mid North Coast). The study found there is a distinct north-south genetic divide centred on the Central Coast, with much higher genetic diversity among the northern populations than southern populations. The higher genetic variation and relatively high numbers of atypical *S. paniculatum* seen in the northern populations may be due to increased hybridisation with *S. oleosum* in this part of its range. These differences may also reflect geographic phenotypic variation, as major biogeographic barriers and/or widely separated habitat are likely to have limited genetic exchange between the southern and northern populations.

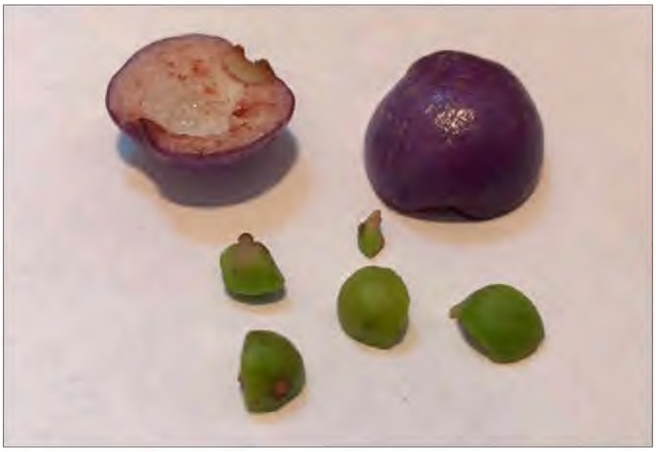

Figure 4. ***Syzygium oleosum*** **fruit with polyembryonic seed. Photo: Aaron Mulcahy**

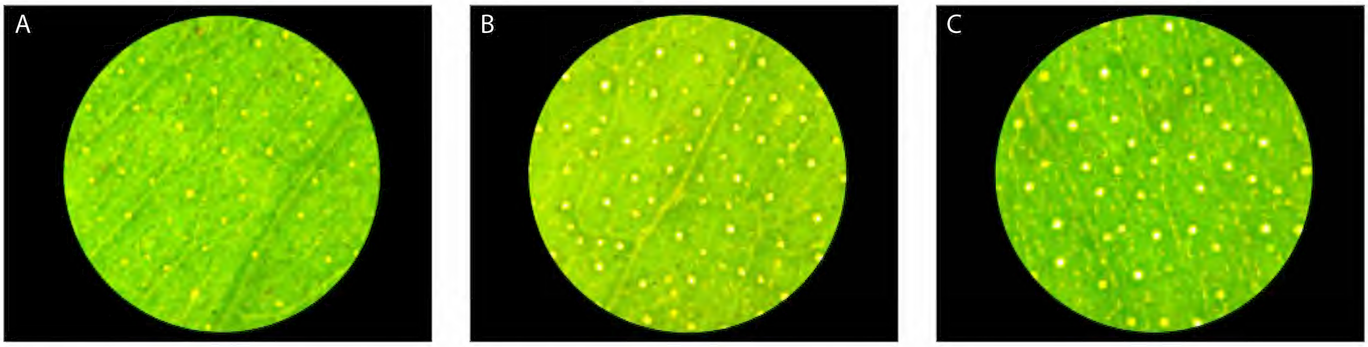

Figure 3. Variation in leaf oil gland size and density (40x magnification) between typical *Syzygium paniculatum* (a), atypical *S. paniculatum* (b) and *S. oleosum* (c). Photos: Luke Foster

At a practical level, our findings suggest that atypical *S. paniculatum* specimens may be (and may have been) overlooked as *S. oleosum* during surveys (including development assessments) using current species descriptions and identification keys (e.g. PlantNET). Misidentification not only influences development outcomes but could also substantially affect population size estimates for *S. paniculatum*.

At a legislative level, the classification of these atypical plants as either *S. paniculatum* or *S. paniculatum x oleosum* hybrids is significant as hybrids are not recognised under NSW or Commonwealth threatened species legislation. Consequently, hybrids of threatened plant species are not currently afforded the same legal protections as their listed parent species. This again has impacts in a development context, but also raises questions about the prioritisation of conservation funding: is current funding being used in the right areas and on the right species?

What are we doing about it?

Ongoing work will investigate the distribution and abundance of atypical *S. paniculatum* specimens across the known range of *S. paniculatum*. This involves revisiting a select number of historical records and reclassifying where misidentification has occurred.

The National Herbarium of NSW is also currently investigating analytical methods that could enable more rigorous and comprehensive genetic testing of *Syzygium* populations. If such methods do prove possible, they will be a crucial step in untangling the taxonomic uncertainty of the atypical specimens.

Conclusion and recommendations

It is currently unclear if the atypical plants are part of the *S. paniculatum* species complex or are hybrids of *S. paniculatum* and *S. oleosum*. Further genetic research is recommended as a priority to resolve the taxonomy of these atypical specimens as the issues arising from this uncertainty could have detrimental effects on the long-term survival of *S. paniculatum*. Until further research is undertaken, the precautionary principle should be followed and advice should be sought from the National Herbarium of NSW for any atypical *S. paniculatum* plants or suspected hybrids. Submission of atypical specimens to the herbarium will also contribute to the collection that can be used in future genetic and/or taxonomic research.

Acknowledgements

We would like to thank Dr Peter Wilson (Royal Botanic Gardens Sydney) and Fiona Miller (Great Lakes NPWS) for their valuable input on this project.

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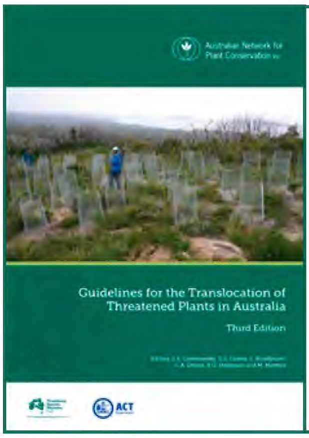
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A new operational policy to support translocations in NSW

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Introduction

Translocations are difficult and complex. Consequently, most environmental agencies across Australia have policies or guidelines that guide the development of translocation projects. The former Office of Environment and Heritage (now Department of Planning, Industry and Environment) recently published new guidelines for translocations in NSW: the translocation operational policy (or 'operational guidelines'). The operational guidelines provide a framework for developing and assessing translocation projects under the *NSW Biodiversity Conservation Act 2016* (BC Act).

Historically, translocations in NSW were guided by the *Policy for the translocation of threatened fauna in NSW* (NPWS 2001), and the ANPC plant translocation guidelines became the 'de facto' policy for plant translocations. The operational guidelines consolidate plants and animals under a single framework, providing guidance that is consistent across taxa and with current legislation. They reflect a more advanced knowledge of the factors influencing translocation outcomes and consider some key contemporary challenges for conservation.

We believe the outcomes of translocations will be greatly improved if people follow the new operational guidelines. Firstly, it can help you consider whether translocation is really an appropriate conservation measure for your target species. If a proposal cannot meet the standards set out in the operational guidelines, there are likely other actions that will be more effective than translocation. Secondly, they provide ample guidance on how to develop your translocation plan. The intended outcome is that more proposals are well-considered and more likely to achieve positive outcomes. Finally, they provide clarity on legal requirements for translocation in NSW, so proponents can spend less time navigating the legislation and more time planning and implementing their translocations.

In this paper, I provide a brief look at novel components of the operational guidelines that are relevant to plant conservation.

ANPC guidelines

The new operational guidelines complement the ANPC translocation guidelines (Commander *et al.* 2018). They reinforce the role of the ANPC guidelines as providing an in-depth analysis of best practice plant translocation in Australia and help put the ANPC guidelines into practice in NSW under the BC Act.

While the ANPC guidelines should guide the design of your translocation project, the operational guidelines set out the information you must include in your proposal to ensure it is consistent with NSW legislation. We recommend reading the ANPC guidelines when designing your project, and the operational guidelines when developing your proposal.

Translocation operational guidelines

Saving our Species

The development of new operational guidelines is timely. The introduction of the BC Act formalised *Saving our Species* (SoS) as the Biodiversity Conservation Program, which is one of the most significant government investments in threatened species conservation in NSW. SoS has the overarching objective of securing as many threatened species as possible for the next 100 years, and it is doing this by developing targeted conservation projects for specific plants, animals and ecological communities at mapped management sites.

SoS conservation projects are developed by species-specific expert panels who determine the priority actions and sites for investment to achieve the 100-year objective for each threatened species or ecological community. With translocation identified as a priority action for over 150 threatened species (including >130 plants), development of the operational guidelines is an important step in helping SoS deliver cost-effective conservation outcomes.

Climate change

Anthropogenic climate change represents a significant threat to biodiversity in NSW. With the rapidity of climate change expected to outpace rates of adaptation or colonisation for many species, there is a need to consider future climatic scenarios when planning translocations.

Climate features in two components of the new operational guidelines. Firstly, it is a key consideration for all translocations in establishing the suitability of recipient sites. Where a recipient site is not likely to remain climatically suitable into the future, it should not be considered a suitable translocation site.

Secondly, translocation is increasingly being proposed as a strategy for conserving species likely to experience declines due to climate change, whether they are already listed as threatened or not. Practical examples of this kind of translocation are few, which reflects general uncertainty about the risks of such translocations, coupled with historically poor translocation outcomes. Nevertheless, those kinds of translocations are likely to become more frequent (but most likely experimental at this stage). Proponents need to show that:

- Climate change is a real threat to the species (Appendix F provides useful references for species vulnerability assessments).
- The proposal is a viable conservation strategy or will provide substantial research benefits.
- The recipient site is predicted to remain suitable for the species under future climate scenarios.

Establishment of *ex situ* populations

Many translocation projects involve a specific step to increase the number of individuals available for translocation. This may include propagating plant material or breeding animals in a captive setting. These approaches are also sometimes used when undertaking research.

Sometimes these approaches are used to establish 'insurance populations', where the conservation intention is not clear. The operational guidelines set out provisions for establishing *ex situ* populations to ensure those actions have a clear conservation purpose. Specifically, they should contribute to the conservation of existing populations, the establishment of new populations or to protect the species against imminent extinction. We also recommend that *ex situ* plant populations are established in accordance with the ANPC germplasm conservation guidelines (Offord and Meagher 2009).

Mitigation translocation

The operational guidelines contain provisions to guide decision-making for mitigation translocations that are not authorised by a development approval. Those provisions help to balance the risks and benefits of the translocation and maximise the potential for successful outcomes. The guidelines outline that mitigation translocations more likely to be supported are those where:

- The target species is a threatened species.
- Creation of a self-sustaining population is likely or there are likely benefits of reinforcement.
- The risks of not translocating are greater than the risks of translocating.
- There are no other options to avoid impacts to threatened species.

Importantly, the guidelines are sufficiently flexible to allow a sensible and pragmatic approach to translocation of plants threatened by development.

Translocation proposal template

The operational guidelines include a translocation proposal template. The template provides proponents with a guide to what information you should consider in planning a successful translocation. The template includes guiding text to clarify the type of information required in each section. The goal is to help you develop a clear proposal that can be processed with minimal delay, so you can get on with your translocation.

Where can I find more information?

Visit our website to read the operational guidelines and learn how SoS is using translocation to conserve threatened species in NSW **(**https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/programs-legislation-and-framework/translocation**)**.

If you are planning a translocation and would like to learn more about how SoS is conserving your specific target species, you can contact the Saving our Species team by email **(**savingourspecies@environment.nsw.gov.au**)** or via our website **(**www.environment.nsw.gov.au/savingourspecies/contactus.htm**)**.

If you have any questions about licensing for your translocation, you can contact the Wildlife Team – Scientific Licensing by email **(**scientific.licensing@environment.nsw.gov.au**)** or phone (02 9585 6406).

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Threatened plant translocation case study:

Zieria baeuerlenii (Bomaderry Zieria), Rutaceae

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The species

- Many-branched to somewhat straggly, long-lived perennial shrub (average height ~80 cm).
- First collected in 1883 in the "lower Shoalhaven", and in 1943 from "Bombaderry Creek".
- Endemic to the Shoalhaven, with a single known population; restricted to ~50 ha on the plateau either side of Bomaderry Creek, north of Nowra, NSW.
- Listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the NSW *Biodiversity Conservation Act 2016*.
- Fruit or seed set has never been observed.

***Zieria baeuerlenii*. Photo: Kylie Coutts-McClelland**

Threatening Processes

- Small population size (stochastic events, genetics).
- Inappropriate fire regime.
- Lack of sexual reproduction (genetic implications).
- Browsing (from native and exotic species).
- Disturbance (human recreation, utility maintenance).
- Drought/climate change.

Deciding to translocate

First collected in 1883, the Bomaderry Zieria (*Zieria baeuerlenii* J.A. Armstrong) has had a single known population, despite detailed surveys, with no evidence to suggest its distribution ever extended outside the Bomaderry Creek locality (DECCW 2010). No fruit or seed set has ever been observed. Vegetative material was collected in 2007 to create an *ex situ* insurance collection of all known genets. An ongoing population decline, and a preference to use *ex situ* individuals rather than discard the ageing stock triggered the decision to undertake an enhancement planting (trial translocation). It was also a learning opportunity to inform future translocations, particularly any implications for augmentation/reintroductions to the *in situ* population.

Aim of the translocation

The short-term aims of the enhancement trial were to:

1. Achieve survival of translocants at Bomaderry Creek at a site additional to the extant *in situ* population.
2. Investigate factors critical to successful translocation for the species.
3. Develop a method for the planting of *Z. baeuerlenii* for future translocations.
4. Increase our understanding of the potential reasons for the decline of the natural *in situ* population.

Translocant survival rates for two primary treatments were tested:

- Manual watering (additional to natural rainfall), and no watering. Best watering horticultural practice was implemented as per the protocols/recommendations of the partner Botanic Gardens.
- Fenced and unfenced, to investigate the effect of browser impacts.

Overall, the project sought to increase the number of *Z. baeuerlenii* plants in the wild and increase knowledge on the species more broadly. Knowledge gained from the trial will assist any future enhancement/augmentation proposals, if deemed necessary for the Bomaderry Creek population.

Translocation working group and key stakeholders

- NSW Department of Planning, Industry and Environment (DPIE): Biodiversity and Conservation and National Parks and Wildlife Service Divisions (formerly the NSW Office of Environment and Heritage).
- Wollongong Botanic Gardens, Booderee Botanic Gardens, Australian National Botanic Gardens.
- Shoalhaven City Council.
- Bomaderry Creek Landcare Group Inc.
- South East NSW Bioregion Partnership.

Biology and Ecology

- Trifoliate leaves covered in velvety hairs. Each leaflet is rounded and blunt, to 12 mm long and 9 mm wide, with curled-under edges.
- Produce masses of small pinkish-white flowers between July/August and October, arranged in clusters of three to seven.
- No fruit set or seeds have ever been observed/recorded.
- Fire-induced re-sprouting; layering, suckering observed (clonal reproduction).
- 20 known genets (Barratt 1999; Sharma 2001), plus five additional probable distinct genets (Barratt 2014 2019). Genetic work suggests it is a distinct species that once reproduced sexually; it is extremely unlikely the species arose as a single hybridisation event followed by vegetative propagation (DECCW 2010).
- Most sites have well-drained, shallow, sandy soils derived from Nowra Sandstone and contain many sandstone outcrops or skeletal soil amongst sandstone boulders (Barratt 1997; PlantNET 2019) across a range of eucalypt open forest, woodlands with shrub understoreys and closed scrub (DECCW 2010).

Site selection

The single recipient site for the enhancement planting trial was ~120 m from the nearest known *in situ* parent *Z. baeuerlenii* plant, mapped as Grey Gum – Blue-leaved Stringybark open forest on gorge slopes southern Sydney Basin Bioregion and north east South Eastern Highlands Bioregion (Plant Community Type 858) (using the NSW Bionet Vegetation Classification application). The habitat was similar to the portion of the natural population in deeper soils. The option to plant in the commonly-inhabited skeletal soils was considered too risky for this first enhancement planting, in terms of *ex situ* stock availability and likelihood of success. The site was considered far enough from the extant population to prevent *in situ* population modification, including minimising potentially negative hygiene impacts. It was large enough for this (and any future) translocation, and had easy access for site preparation, planting, maintenance (specifically water delivery) and monitoring activities.

Translocation proposal

The proposal for enhancement planting was prepared in accordance with Vallee *et al.* (2004). A revised proposal addressing written feedback from internal reviewers was submitted to, and subsequently approved by, the (then) NSW Office of Environment and Heritage as Scientific Licence SL101894.

Left to right: Enhancement planting site (planting day) and enhancement planting site (post-fire). Photos: Kylie Coutts-McClelland

Pre-translocation preparation, design, implementation and ongoing maintenance

Source material (vegetative cuttings) collected from the likely/known different genets in 2007 was propagated by the Wollongong Botanic Gardens, the Australian National Botanic Gardens, and the Booderee Botanic Gardens. Seedlings for the trial were grown to tubestock or pots up to 250 mm under strict hygiene protocols, sourced primarily from the Wollongong Botanic Gardens' collection (from stock re-propagated in 2016). For experimental rigour, only genets with at least 21 individuals were included: nine 'insurance' individuals to keep the insurance population secure as per the Botanic Gardens' recommendations, and 12 plants for translocation. Twelve genets qualified, with 12-60 individuals from each genet, maximising genetic diversity of the stock available at the time of planting. As such, the maximum number of translocants (316) were planted in mid-May 2017.

Individual translocants within each genet were numbered sequentially, regardless of pot size. To investigate the effect of fencing and/or supplementary watering, translocants were then randomly assigned to one of the four treatment groups: nil treatment; watered; fenced; watered and fenced. Based on a randomly assigned temporary number, translocants were planted in sequential order within a 1 m^2 grid cell plot. Tree bases or large shrubs voided 15 cells, and the next available (sequential) cell was used. Each plant was tagged with a metal tag with a code identifying the genet, the numbered individual of that specific genet, pot size, treatment, and the year of planting. An additional orange horticultural tag was attached to translocants within the watered treatment to aid identification during the watering visits.

Corner star pickets and side plot pegs were installed, mapping out the 1x1 m grid cells. Planting was undertaken in mid-May 2017 to align with milder temperatures and allow sufficient establishment time prior to summer. Holes were dug on the day of planting and each of the 316 translocants was watered in with 1 L within a 10 cm radius of the plant base. Translocants in the fenced treatment were immediately individually fenced with a cylindrical open top cage (40 mm wire mesh, 1.4 mm gauge, 60 cm high), secured around the base with tent pegs.

Timing of the supplementary watering for translocants in the watered treatment used modelled landscape actual evapotranspiration and precipitation values from BOM (2019) to determine daily moisture loss/gain. Plants were watered when the cumulative moisture loss exceeded -40 mm. Each of the 158 'water treatment' translocants were watered with 1 L water, within a 10 cm radius of the plant base. Plants were watered on 21 August 2017, 22 September 2017, 6 December 2017, 29 January 2018, 17 April 2018, 25 September 2018, 26 November 2018, 24 January 2019, 11 March 2019, and 2 May 2019.

Plants were monitored with a full survey (assessing a range of plant health indicators) on planting day, and one, two, three, six, nine, 12, 15, and 21 months post-planting, and a part survey (assessing flower status and survivorship only) 25 months post-planting. Translocants were assigned a health score using a sliding scale where three is the highest score and zero is assumed dead. Fixed photo points also monitored changes in the habitat. Site integrity was monitored during surveys and opportunistically (e.g. fencing intact, pest or weed impacts, signs of vandalism).

Subsequent actions

A bushfire on 15 August 2018 burnt the whole translocation site and the whole natural population excluding three genets. This introduced an additional 'treatment' to the design. The original experimental design was maintained, with monitoring and watering continuing until the end of Year Three. An additional metal in-ground peg was installed for each translocant post-fire (including all plants assumed to be dead) to aid identification of plant location. Melted orange horticultural tags were also replaced, as needed.

The translocants will continue to be monitored for a minimum of three years post-planting, after which a review will decide on further monitoring/management/ experimental design arrangements and timeframes.

Outcomes/Outputs

Preliminary results are presented; they exclude statistical and multivariate analyses.

The *a priori* short-term target of 10% survival at Year 1 was met (75% survivorship, Figure 1). Thirteen months post-planting, 70% of translocants were alive. Twenty-five months post-planting, and 10 months post-fire, no translocants presumed dead pre-fire had re-sprouted. An additional 50% of the translocants died after the fire. Twenty per cent of the original translocants survived 10 months post-fire.

There was a post-fire plant health transition. Immediately post-fire, plant health varied (health score 1-3); two months on, all surviving plants were in poor condition (health score 1); 10 months post-fire, all surviving plants were in good condition (health score 3). Translocants that survived 10 months post-fire (25 months post-planting) displayed lush, and often vigorous, new growth re-sprouted from the plant base/rootstock.

The mid- to long-term target of >60% survival was on-track pre-fire, however can no longer be achieved having lost an extra 50% of the original translocants 10 months post-fire, in addition to the pre-fire 30% loss.

Pre-fire, the mid- to long-term target to retain full genet representation was also met. Different genets had different survival rates pre-fire (50-100% 13 months post-planting, Figure 2), and 10 months post-fire (0-42 %

25 months post-planting). Post-fire genet survival of translocants alive two months pre-fire ranged from 0-56 %. Genet 12 was lost, and five other genets had only one or two individuals (2-17% survivorship of the original individuals). Disproportionate numbers of individuals planted from the different genets may have influenced the results; some genets are known to perform better in the *ex situ* collections (J. Beattie, pers. comm. 2017).

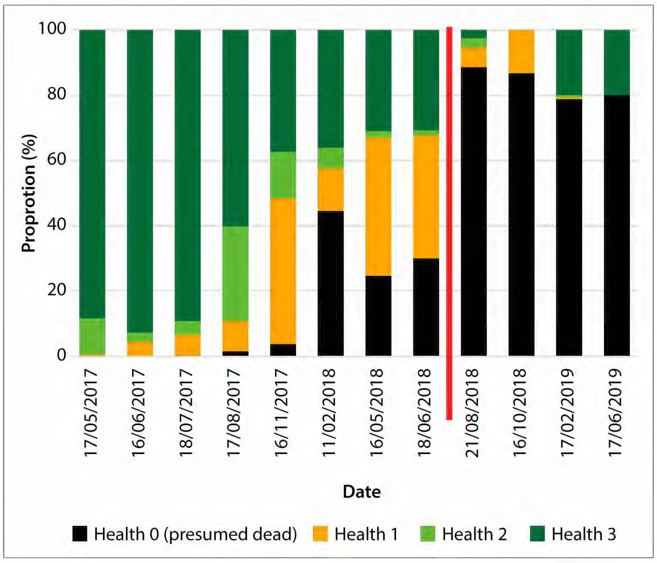

Figure 1. Bomaderry Zieria translocant survival (health score 0-3) timeline. The red line denotes the bushfire.

Using pot size as a surrogate of plant age, younger plants had higher survival rates pre- and post-fire (Table 1). Sixty-one per cent of the younger translocants alive pre-fire survived 10 months post-fire. Post-fire survival of pre-fire survivors was ~20% for all other plant ages.

Watering and/or fencing improved survivorship both pre- and post-fire (Figure 3). Thirteen months post-planting, survivorship was highest for the watered and fenced treatment. Twenty-five months post-planting, survivorship was highest for the watered treatment. Survivorship of pre-fire individuals after the fire was highest for watered individuals (39%), followed by watered and fenced (27%), nil treatment (26%) and fenced (22%). Possible biases from genet and pot size within treatments warrants further investigation in terms of resilience to the fire, and survivorship more broadly, to disentangle their level of influence.

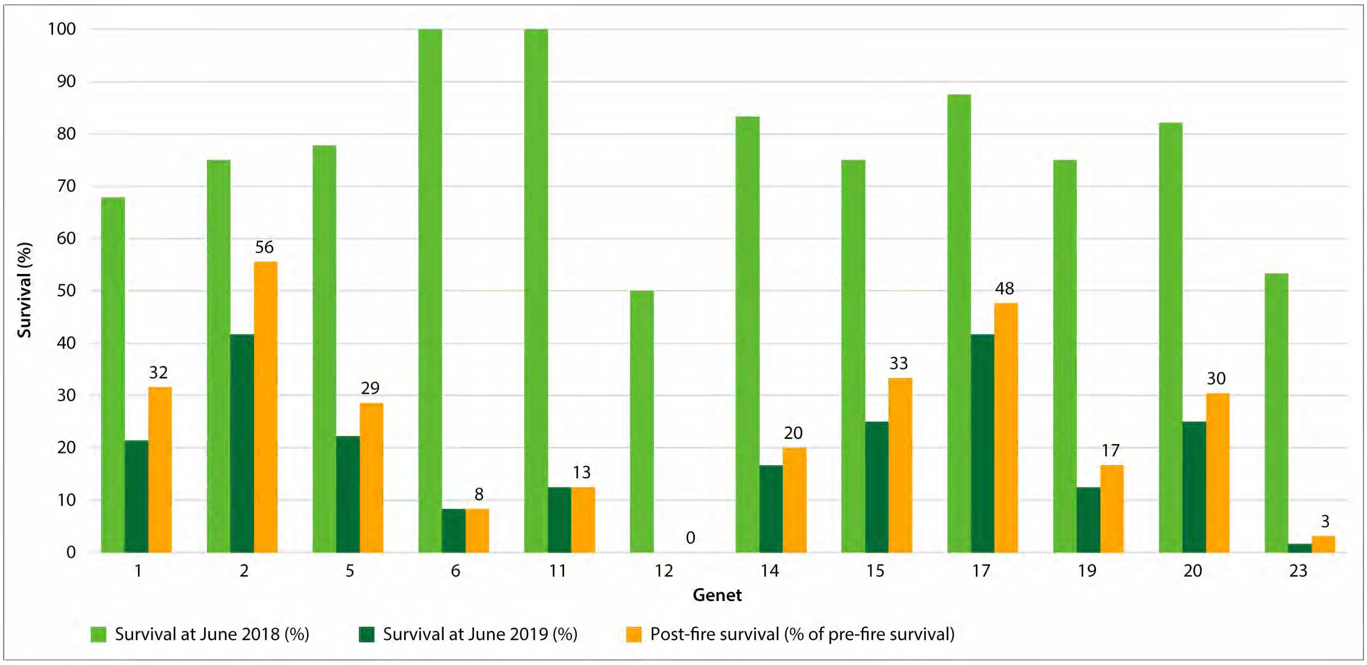

Figure 2. Bomaderry Zieria translocant survival across genets.

Table 1. Bomaderry Zieria translocant survival for different pot sizes (where pot size is a surrogate for plant age).

Pot size (mm)	Sample size (n)	Survival (%) 13 months post-planting; 2 months pre-fire (June 2018)	Survival (%) 25 months post-planting; 10 months post-fire (June 2019)	Survival (%) of individuals alive 2 months pre-fire, 10 months post-fire
50-100	48	85	52	61
120-125	158	61	13	21
140-175	91	76	16	22
200-250	19	79	16	20

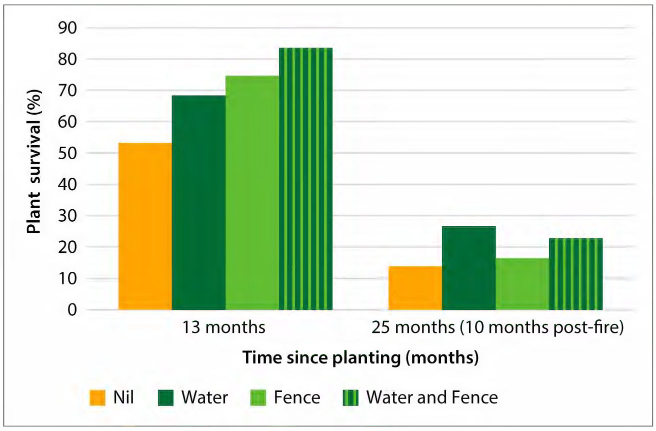

Figure 3. Bomaderry Zieria translocant survival across treatment groups.

As at June 2019: 54 plants had insect damage (86% of the surviving translocants); and seven plants had browsing damage. Insect and browser (native and exotic) damage were also reported in the natural population, post-fire-recovery.

The interrelationships between, and determinant strengths of, the variables of treatment, genet and pot size with survivorship needs further analysis. They may help to explain some of the currently unexpected trends; for example, why plants in the watered treatment have higher survival rates than plants in the watered and fenced treatment.

What we learned

- Plant sufficient numbers of translocants to maximise the likelihood of success, allowing for natural loss and for stochastic events (e.g. fire), as per Silcock *et al.* (2019).
- Ensure there are sufficient resources, human in-kind and financial, for the longer-term monitoring and management of any translocation/augmentation attempt.
- Propagated Bomaderry Zieria *ex situ* seedlings can survive transplantation back into the natural environment.
- Watering and/or fencing improves *Z. baeuerlenii* survivorship generally (and may offer added resilience to surviving a bushfire, thus far at least). The *in situ* population appears to support these findings, in terms of improved survivorship when manually watered during times of low rainfall, and when fenced.
- Certain *Z. baeuerlenii* genets, and younger plants, appear 'stronger' in terms of their survivorship both pre- and post-fire.
- Fire may induce re-sprouting of healthy, new stems of increased vigour, provided the rootstock is sufficiently protected and hydrated at the time of the fire, and that sufficient follow-up rain falls post-fire.

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Colonial and twentieth-century management of exotic species threatening intrinsically valued indigenous flora: Susan Island, Lumley Park, Broken Hill

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In 1894 the trustees of a local reserve in northern New South Wales (NSW) recognised and took action to manage the threat posed by an intrusive exotic flora species to a rainforest community. Notably, they valued and were motivated to protect the biodiversity and beauty of the rainforest *i.e.* its *intrinsic* values, and not just its potential as a source of recreation, resources or revenue. This significant colonial project, possibly the earliest documented example of its kind and now reported for the first time, two comparable 1930s undertakings, and several conservation management lessons that these projects and their lengthy provenances illustrate and sustain are presented in this article.

Susan Island

Cedar brush preservation

From time immemorial the lands of the Clarence River valley in northern New South Wales (NSW) were traditionally occupied and tended by the Bundjalung, Gumbaynggirr and Yaegl Aboriginal Australian nations. Settler decimation of the valley's *cedar brush*, today known as the protected flora community *Lowland Rainforest on Floodplain in the NSW North Coast Bioregion*, occurred between 1840 and 1860 (NPWS 2012, 3-4). However, the 59 hectares of rainforest that densely covered Susan Island, in the Clarence River, Grafton, survived this onslaught largely intact. The island was declared a reserve for public recreation in 1870.

Reserve trustee James Fowler Wilcox, naturalist, valued the biodiversity and uniqueness of the rainforest:

"the cutting of timber, shrubs, grasses, or any plants should be strictly prohibited as there are many choice plants such as palms, Livingstonia, Flindersia, brachychiton, melaleuca, alstonea, Grevillea… all peculiar to the brushes…[*sic*]" (Anon., 'Acclimatization: Zoology &c., of the Clarence River', *Australian Town and Country Journal*, April 30, 1870).

The reserve's trustees took action to protect the cedar brush:

"The Trustees, being desirous of preserving the indigenous timber and plants upon this Island, from destruction …the public are hereby CAUTIONED AGAINST CUTTING DOWN, or OTHERWISE INJURING THE TIMBER or PLANTS…[original emphasis]" (Bawden *et al*., 'Susan Island', *Clarence Richmond Examiner New England Advertiser* [*CRENEA*], May 24, 1870).

This was a bold stance. Ku-ring-gai Chase reserve, Sydney, NSW, was set aside in 1894 and is now regarded as a pioneering example of colonial nature conservation. Reserve campaigner Eccleston Du Faur specifically stated that he was motivated by a desire to preserve its indigenous flora and fauna (Mosley 2012, 193-194).

The Susan Island trustees resisted persistent community pressure to raze all of the rainforest for development. Throughout the 1870s and 1880s they continued to pursue a policy of protecting its biodiversity and beauty:

'The trustees have desired to preserve the island...visitors will see that giant of our brushes, the great figtree...the great red and flooded gums, the cedar, the bean, the beauteous tamarind and tulip trees...' (Anon., 'Susan Island', *CRENEA*, 20 January, 1880).

In 1887 the local militia and NSW government levelled one hectare of rainforest for a rifle range, and over the years the trustees constructed several tracks and two picnic areas, possibly to encourage appreciation of the flora and avifauna. Nevertheless, by c.1890 this work had claimed only seven per cent of the rainforest, with the remainder still relatively undisturbed.

Exotic species management

Unfortunately, as all of this clearing had taken place towards the mid-section of the island, opportunities for lantana (*Lantana camara*) to establish within this now segmented section of rainforest were created. Probably spread via bird droppings, the potential threat was documented in September, 1894:

“This plant, unless checked, will in time, it is feared, overrun and consequently destroy the beauty of the natural and indigenous brush and trees. An effort is now being made to keep it in check…” (Anon., ‘Susan Island’ *Clarence & Richmond Examiner*, 8 September, 1894).

As well as the work done in 1894, trustee and naturalist James Clarence Wilcox (son of James Fowler Wilcox) arranged for more weed cutting in c.1900. It failed, and by the 1920s lantana, facilitated by cattle grazing and fire, had overrun the rainforest in the mid-section of the island, leaving it in a bare condition by the 1940s (Figure 1).

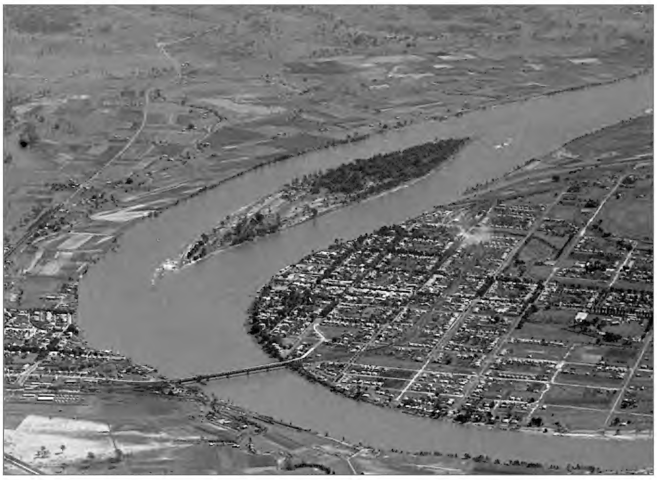

Figure 1. Susan Island, Grafton 1945. Mid-section lacking rainforest vegetation. Future nature reserve located at further end of island. Source: Charles Pratt; State Library Victoria

Subjected to only informal trails, an adjacent and relatively intact 16.5 hectares portion of the rainforest offered far less opportunities for lantana colonisation and other negative impacts, and so persisted in this good condition for many decades. Since 1982 it has been preserved and restored as the NPWS managed *Susan Island Nature Reserve* (Figure 1).

These two contrasting outcomes suggest potential for the exercise of the same long-term durability and resilience by other indigenous and intact flora communities. They also warn that even the most seemingly minimal disturbance can negate this capability and serve as an ignition point for exotic species establishment.

Two twentieth-century projects

The historical record suggests that it was not until 1935 that similarly inspired indigenous flora management projects occurred in Australia. Both of them are also now considered to be early examples of the contemporary practice of *ecological restoration* (McDonald in Jordan & Lubick 2011, 72-75).

In 1935 at Alstonville, northern NSW, Ambrose Crawford and colleagues commenced manually eradicating multiple invasive flora species within a degraded one and a half hectares patch of rare *Big Scrub*, or *Lowland Sub-tropical Rainforest*, valued for its biodiversity and aesthetic features. Implemented over many decades, this ongoing adaptive management has proved to be an effective long-term substitute for the actual elimination of the external sources of the continuous weed intrusion. With regular maintenance, *Lumley Park reserve* thrives today (Figure 2) (Lymburger 2018).

In 1923 Albert Morris, at Broken Hill, NSW, documented the devastating impacts of introduced exotic fauna on indigenous flora communities that he valued for their intrinsic qualities. Between 1935 and 1938 he and associates initiated technologically simple (fencing) but ecologically inspired natural regeneration trials and projects that transformed apparent desert by enabling indigenous flora communities to successfully re-establish themselves (Figure 3).

Realised by a partnership of community, business and state and manifesting today as the *Broken Hill regeneration area,* this work demonstrated that apparently irreversibly degraded and seemingly non-existent indigenous flora ecosystems and their associated natural resilience could be revived.

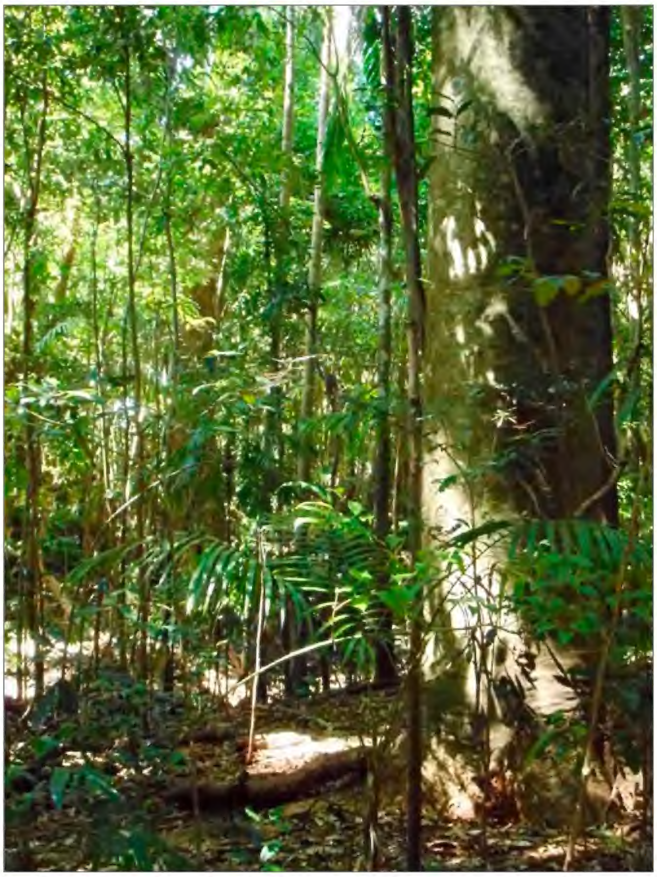

Figure 2. Restored Lumley Park rainforest reserve 2018. Photo: Peter Ardill 2018

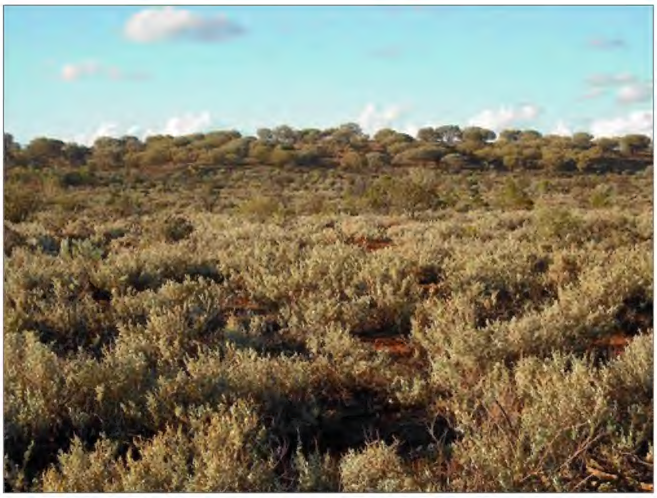

Figure 3. Saltbush with ridge Mulga at Broken Hill regeneration area 2017. Photo: Peter Ardill

The lessons to be learnt from these historic projects will come as no great surprise to contemporary conservation managers, regenerators and restorationists. It is the long-term efficacy of the outcomes that provides some encouragement, as globalisation and global warming rapidly present fresh challenges for our indigenous flora species.

Acknowledgements

Dr Tein McDonald commented on an early version of this research. Trove, National Library of Australia provided online historic document access.

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News from the Australian Seed Bank Partnership

Seed collecting way down south

LORRAINE PERRINS* AND JAMES WOOD

Royal Tasmanian Botanical Gardens, Hobart, Tas.
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The Macquarie Cushion

Macquarie Island lies approximately 1,545 km southeast of Tasmania, and is an Australian Subantarctic Territory managed by the Tasmanian Government Parks and Wildlife Service (TASPWS). The island has 44 species of seed-bearing plants, four of which are endemic. One of the endemics is *Azorella macquariensis* (Macquarie Island cushion plant), a keystone species of the feldmark covering about 45% of the Island. Since 2008 *Azorella* has undergone a catastrophic decline due to dieback, the causes of which are uncertain, resulting in *A. macquariensis* being listed as a Critically Endangered species.

As previously reported in APC 21(2): 25-26 and APC 23(2): 25-26 the Royal Tasmanian Botanical Gardens (RTBG) established an *in-situ*, potted conservation collection of *Azorella* on Macquarie Island. By Spring 2013 fifty-four plants had been potted up to maintain a viable population, with the ultimate goal to harvest a large conservation seed collection for the Tasmanian Seed Conservation Centre (TSCC).

Return to the island

In 2016 the RTBG was successful in gaining a placement and support on Macquarie Island from the Australian Antarctic Division (AAD) for RTBG Horticultural Botanist Natalie Tapson to be based on the island for the entire summer season. Previous trips to Macquarie Island had collected seed for the TSCC however these trips had been fairly time limited. Having Natalie based on the island for the summer period meant that she had more opportunity to make a larger collection and sample species previously missed.

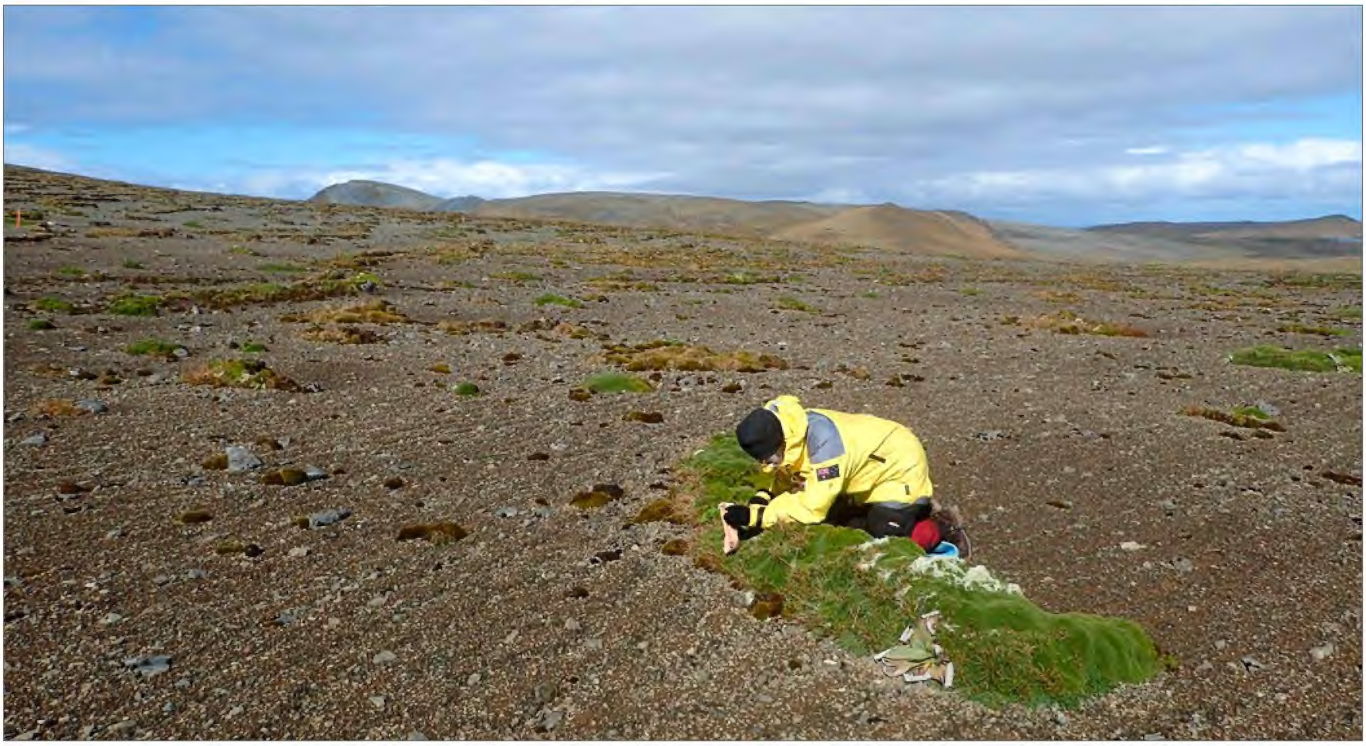


Figure 1. Natalie Tapson collecting seed from *Azorella macquariensis* on the Central Plateau. Photo: Natalie Tapson.

April 2016 saw RTBG nursery staff busy packaging and transporting materials to the AAD's headquarters at Kingston to be inspected and subsequently shipped down to Macquarie Island for the summer season. Forceps, 30 kg of silica gel desiccant, 3 plastic drums, drying trays, cloth bags and plant presses were all bundled up and sent south as part of our *Azorella macquariensis* Conservation Program, which has been running, supported by TASPWS and the AAD, since 2009.

Collecting against the elements

With a temperature range between 3-8°C during summer, constant wind at around 25 km/h, regular wind gusts of up to 170 km/h, and rain and snow showers frequent, the task of harvesting tiny seeds in the "furious fifties" latitude is not for the faint hearted! Seed collection from many of the species on the Island involved crouching over the plants and individually picking out the small seeds with forceps, often for hours on end. Hypothermia is a very real risk under these conditions.

The vegetation of Macquarie Island is a testament to the high rainfall experienced there, but high humidity is not necessarily conducive to preserving seeds. In order to minimise viability loss in the seed before its arrival at the seed bank, it was imperative that Natalie reduce debris and dry them down sufficiently in a cool environment. The silca gel desiccant and sealed plastic drums were used for this purpose and worked very well.

As is typical for members of the Apiaceae, the diminutive flowers of *Azorella* produce a maximum of 2 seeds each and these ripen during March and April. The original expectation was to harvest seed from the healthy potted *Azorella* as well as the wild population, however seed set was low so only the wild plants were sampled. Added to this was the concern that some seed may not have been fully ripe at harvest. To deal with this issue, collections of nearly ripe seed were kept slightly moist, but well aerated during the transportation. Once back at the TSCC they were transferred into humidity boxes to complete the ripening process before being dried down for storage.

As a general rule of thumb, the number of seeds considered to make a good, long term, conservation seed collection is typically 10-20,000 from a minimum of 50 individuals. With a concerted effort, (on one occasion consisting of 5 hours of continual surgical-like seed plucking!) just over 4,000 seeds from 365 individual *Azorella macquariensis* plants were harvested, an impressive result given the difficulties of the job and time constraints.

Additional targets

As well as harvesting *Azorella* seed Natalie was also able to collect 12 other species (see Table 1) during her summer on Macquarie Island amounting to a staggering 562,131 seeds in total. Many of these species had never been collected as seed before and work on their germination requirements will commence in the near future.

Additionally, Nat also collected live plants of the endemic orchid *Corybas sulcatus* for the RTBG's Native Orchid Conservation and Research Program as well as soil collections for an international program assessing global soil fungi distribution. This appears to be the first time *C. sulcatus* has been grown. Images of the plants at the RTBG can be seen here https://www.flickr.com/photos/tags/corybassulcatus .

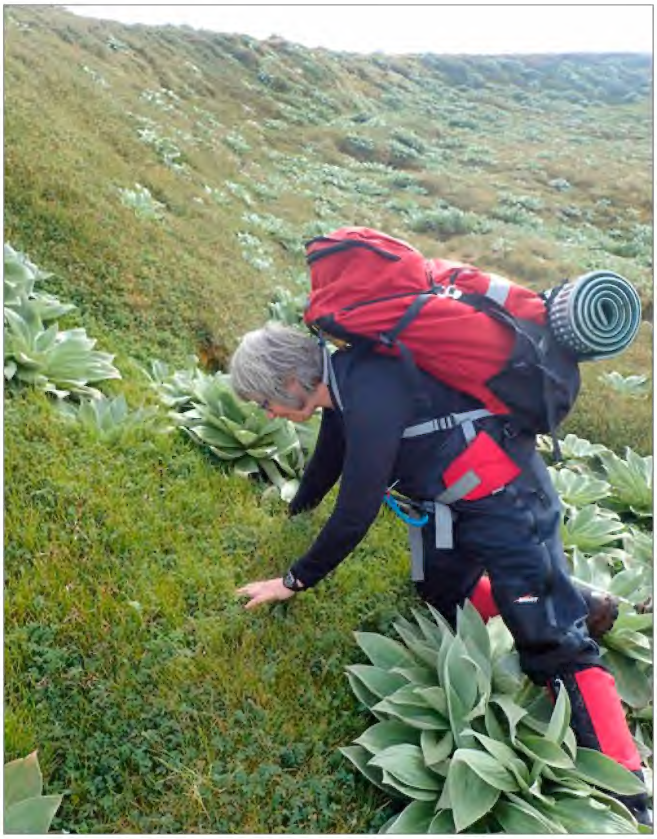


Figure 2. Nat surveying for seed harvests. Photo: Natalie Tapson.

The 'captive specimens' of *Azorella macquariensis* in our Macquarie Island seed orchard will remain closely monitored over the next few years and continue to be maintained as a conservation collection, effectively 'buying time', whilst further research is being conducted for the future preservation of this species. The seed collections will be stored in the TSCC as a back-up conservation collection and research into the germination requirements for each species harvested conducted.

For more information on the RTBG's *Azorella* program go to: http://gardens.rtbg.tas.gov.au/azorella-macquariensis/

The Royal Tasmanian Botanical Gardens would like to acknowledge the Australian Antarctic Division for the ongoing support of this program.

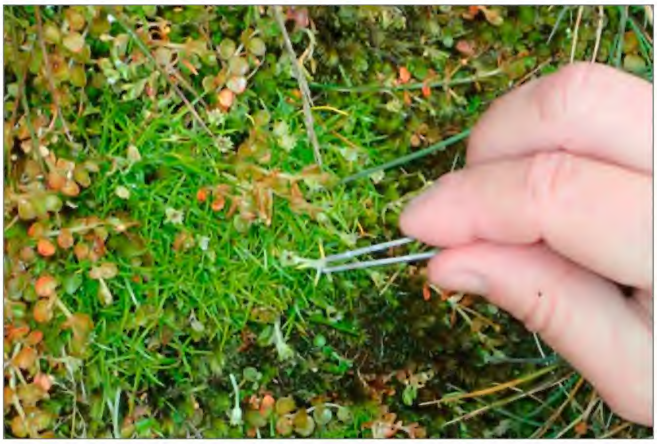


Figure 3. Tedious work collecting *Colobanthus apetalus* var. *alpinus*. Photo: Natalie Tapson.

Table 1. Summer 2017 seed collections from Macquarie Island.

Accession Number	Collectors Number	Family	Taxa	Seed Quantity	Viable Seed
0021516	NT-0678	Caryophyllaceae	*Colobanthus apetalus var. alpinus*	44,296	44,296
0021527	NT-0679	Caryophyllaceae	*Colobanthus muscoides*	26,297	26,297
0021538	NT-0680	Rubiaceae	*Coprosma perpusilla subsp. subantarctica*	11,640	11,252
0021560	NT-0682	Caryophyllaceae	*Colobanthus muscoides*	40,161	40,161
0021571	NT-0684	Brassicaceae	*Cardamine corymbosa*	12,993	12,993
0021582	NT-0687	Ranunculaceae	*Ranunculus crassipes*	10,097	9,760
0021593	NT-0688	Cyperaceae	*Uncinia divaricata*	796	756
0021604	NT-0690	Asteraceae	*Leptinella plumosa*	21,007	21,007
0021615	NT-0691	Rosaceae	*Acaena minor*	42,220	37,998
0021626	NT-0692	Rosaceae	*Acaena magellanica*	218,864	201,668
0021637	NT-0693	Apiaceae	*Azorella macquariensis*	4,585	4,110
0021648	NT-0694	Onagraceae	*Epilobium brunnescens subsp. brunnescens*	124,321	108,781
0021659	NT-0695	Portulacaceae	*Montia fontana subsp. fontana*	998	948
0021670	NT-0696	Callitrichaceae	*Callitriche antarctica*	3,856	3,470

ANPC member profile

Michael Elgey

What is your current position?

Recently I have accepted the role as Curator of both Rockhampton Botanic Gardens (a recently joined ANPC Corporate Member) and Kershaw Gardens with Rockhampton Regional Council. Previously I was a Horticultural Supervisor at The Royal Botanic Gardens, Sydney

What projects are you working on at the moment?

In addition to my horticultural teams vigorously working to improve the amenity display horticulture across both sites, we are actively involved with two flagship conservation projects:

- Native Plant Giveaway. This is open to all community groups, organisations and residents of Rockhampton Regional Council. Plants that we give away are grown from locally sourced material throughout the year from our local bushland sites, remnant patches and road side verges.
- Translocation of *Cycas ophiolitica*. Rockhampton Regional Council is fortunate to be trustees of several mature populations of *C. ophiolitica*. With recent required road works that impact populations of *C. ophiolitica* my Nursery Team have undertaken the project to translocate this species to new sites in close proximity to the original population or house specimens at our Nursery for future reintroduction to the original site post construction works.

How did you end up working in plant conservation?

I have always been fascinated by the natural world and had an appreciation for plants from a young age. Growing up in Western Sydney in the early 1990's there was a lot of cleared unused land to explore which I did most weekends and holidays. Within one of these sites I can vividly remember seeing a remnant patch of *Allocasuarina littoralis* and thinking it was like an oasis in such a barren open area and so vastly different to the creek lines in the Blue Mountains where we spent time camping. Then as an Apprentice Horticulturalist I wanted to broaden my skills and knowledge so I undertook tertiary studies in Conservation and Land Management and Environmental Biology plus whenever possible I volunteered with Conservation Volunteers Australia. Then whilst employed with the Royal Botanic Gardens, Sydney I was fortunate to work in both the Science and Horticultural branches of the organisation. This experience afforded opportunities for me to be involved directly and indirectly with botanical conservation projects. The exposure to these conservation projects really refined my interest and assisted in developing my practical skills and theoretical knowledge on botanical conservation which I have been able to bring to Rockhampton Regional Council.

Michael Elgey. Photo: Skye Michaels

What is your favourite plant and why?

At Rockhampton Botanic Gardens I have discovered the genus *Dorstenia* which has really grabbed my interest. This peculiar genus has extremely diverse growth forms and rather unusual floral structure. More surprisingly this genus is in the family Moraceae yet they are so different to anything I have seen previously in this family group. Saying this I still can't go past a *Brachychiton rupestris* (or any *Brachychiton* specimen really) without having a second glance or stopping for an up close look to appreciate their beauty. They are truly an iconic and charismatic Australian native species.

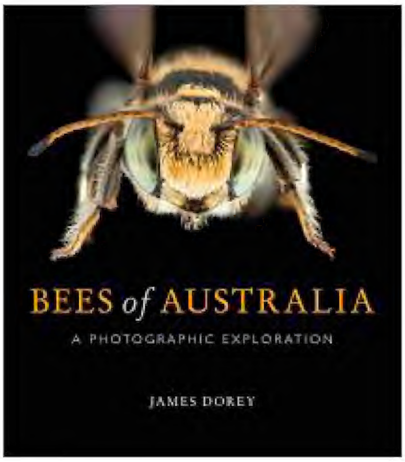
Why do you think the ANPC network is important and what do you see as our priorities?

As ANPC's mission statement states "*to promote and improve plant conservation*", I don't believe that ANPC has ever fallen short of this mantra. I see the ANPC as a key resource conduit in Australia between community organisations, citizen science groups, regional Botanic Gardens & Parklands and larger botanical science based organisations. A key priority I see for ANPC is to always evolve and stay relevant to the ever changing threats and challenges facing our native flora and the larger natural environment. By making hard decisions now we are able to better conserve and promote our native flora in the future.

Book review

Bees of Australia: a photographic exploration

James Dorey
CSIRO Publishing. October, 2018. Paperback, 224 pages, AU $49.99



Over the last two decades, advances in technology have increased at an exponential rate. The widespread availability and affordability of new technologies is reflected in how we can now communicate science and nature on a global scale.

In James Dorey's new book, *Bees of Australia: a photographic exploration* we are treated to the stunning impact that high resolution digital photography has for communicating the incredible diversity of species. James makes no illusions that this book is a complete guide to all Aussie bees (there are other resources for that). Instead, the stunning selection of species in this book provides a discussion point for Australian bees and, more broadly, conservation.

The book is divided into "chapters" by State/Territory, each highlighting some of the wonderful diversity of bees found within. Each species is accompanied by some basic ecology and distribution descriptions. On that note, scientific jargon is kept to a minimum, but there is a glossary provided to help the reader in this regard. I also appreciated the silhouette that represents the actual size of each bee species.

At the end of each "chapter" is a short discussion of different topics, including the importance of bees in the landscape, their role in pollination, threats to species and the typical social behaviours. The final "chapter" of the book is dedicated to the importance, and role of, museums. This is particularly poignant as so many Australian bees are scientifically undescribed. Guest writer Michael Batley from the Australian Museum in Sydney stresses that preserved specimens in museums are crucial for taxonomically describing species.

This photo book is a fantastic illustrative journey showcasing the incredible diversity of bees that call Australia home. And like many insect-groups, so little is known about their ecological importance. Perhaps the greatest strength of this book is that it can be opened at any page at any time and thoroughly enjoyed by just about everyone!

Reviewed by Nathan Emery

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News

ANPC News

Healthy Seeds project has commenced!

The ANPC is very excited to announce that we have embarked on the 18 month 'Healthy Seeds' project funded by the NSW Government through its Environmental Trust, to deliver an evidence-based Roadmap to secure a reliable, genetically-appropriate, native seed supply in NSW for restoration, and to update the Florabank Guidelines for best practice native seed collection and use. An audit and investigation into past and present Seed Production Areas (SPAs) will also be undertaken. A consortium of partners will be established across the native seed and ecological restoration sectors to oversee the project.

SPAs are seen as central to overcoming shortfalls in high quality native seed for ecological restoration, and for improving seed supply reliability, reducing pressure on wild populations, and for improving genetic provenance and diversity to ensure the long-term health and resilience of restored ecosystems. The Florabank Guidelines, first developed in 1999 in partnership between Greening Australia, CSIRO, and Bushcare, will be revised and updated with the latest science. These guidelines remain the benchmark for best practice native seed collection and use in restoration and are widely used by practitioners – the closest thing to an industry standard that is currently available.

Find out more at **https://www.anpc.asn.au/healthy-seeds/**

Australasian Seed Science Conference to be held in Canberra 5-9 April 2020

The ANPC is proud to be collaborating with the Australian Seed Bank Partnership on this conference which will be hosted by the Australian National Botanic Gardens with the following themes:

1. Seed biology and evolutionary ecology – *Unlocking the challenges of germination, dormancy and seed ecology in a changing world.*

2. Seed sourcing and end-use – *Considering genetic diversity, restoration and translocations as well as sector specific approaches to seed conservation and use.*

3. Seed and gene bank management – *The ins and outs of managing ex situ seed banks and gene banks and the methods for maximising seed quality and longevity.*

4. Seeds in culture and society – *Sharing stories and learning about cultural seed use, including collaborations between traditional use and ex situ seed banks and gene banks.*

Visit the website and sign up to received more information as the conference program develops.

https://seedscience2020.com.au/

Photo credit: Andrew Crawford, DBCA

AUSTRALASIAN
Seed Science
Conference

5-9 April 2020
Australian National Botanic Gardens
Canberra, Australian Capital Territory
seedscience2020.com.au

The Australian Seed Bank Partnership will hold the Australasian Seed Science Conference in April 2020. The Conference will be held at Kambri, Australian National University, hosted by the Australian National Botanic Gardens.

Delegates will have the opportunity to meet and share ideas and attend workshops with leading experts, focusing on the importance of seed science to the future of plant conservation and food security.

General enquiries: assc2020@arinex.com.au | Sponsorship: coordinator@seedpartnership.org.au

Cuttings: Plant news from around Australia

Editors' note: Cuttings news excerpts are clipped from a diversity of sources. To read the articles in full follow the links attached to each clipping. The views expressed in these articles are those of their authors and do not necessarily represent the opinion of the ANPC.

The New South Wales Threatened Species Scientific Committee has re-vamped its webpages

The new homepage is at https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee. Content remains much the same but links have been simplified. A useful and time-saving innovation is a keyword-searchable and dynamic list of the Committee's Final Determinations of extinction risk (previously ordered by date only) – for this page see: **https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/nsw-threatened-species-scientific-committee-final-determinations**

Critically endangered plant *Grevillea caleyi* on video

As part of the Saving our Species program, NSW OEH have put together this very short video about one of the rarest plants in Sydney. *Grevillea caleyi* only grows on Sydney's northern beaches, restricted to an 8 km square area around Terrey Hills, approximately 20 km north of Sydney. Find out what it needs to survive. **https://www.environment.nsw.gov.au/OpenOEH/video.htm**

'Coral bleaching event equivalent': alarm sounded for Queensland Wet Tropics Area

The board of the Wet Tropics Management Authority has demanded urgent action, saying "extreme heat is the Wet Tropics World Heritage Area's coral bleaching event equivalent". In a statement released today, the board pointed to "concerning new evidence" that revealed an acceleration in the decline of the biodiversity of the Wet Tropics of Queensland's World Heritage Area. **https://www.australiangeographic.com.au/news/2019/04/coral-bleaching-event-equivalent-alarm-sounded-for-queensland-wet-tropics-area/**

New population of aquatic carnivorous plant found in the Kimberley

Researchers from Curtin University have discovered a new population of critically endangered aquatic carnivorous plants in Western Australia's remote Kimberly, following a 10-year search of the region. During a recent botanical expedition to the northern Kimberley, Dr Adam Cross and Honours student Thilo Krueger discovered several thousand Waterwheel Plants (*Aldrovanda vesiculosa*) in a billabong on Theda Station, east of the Mitchell Plateau. "This is the first time this species has been found in the Kimberley for more than 20 years," said Dr Cross. "The only other known population from Western Australia is more than 2,000 kilometres away near Esperance in the State's south, where a small population of only a few dozen plants was discovered in 2007." **https://www.australiangeographic.com.au/news/2019/05/new-population-of-aquatic-carnivorous-plant-found-in-the-kimberley/**

Melbourne reimagined with 40,000 native plants in 'Living Pavilion'

The University of Melbourne has had a makeover. Over the past fortnight, more than 40,000 Indigenous plants have been shipped to the university's Parkville campus. From native mint to kangaroo grass, the project celebrates Indigenous knowledge and imagines what Melbourne's inner-north might have looked like prior to European settlement. **https://www.smh.com.au/entertainment/art-and-design/melbourne-reimagined-with-40-000-native-plants-in-living-pavilion-20190506-p51khf.html**

One million species at risk of extinction, UN report warns, and we are mostly to blame

One million of the world's species are now under threat of extinction, according to the biggest-ever review of the state of nature on Earth. The UN-backed report was three years in the making and was based on systematic reviews of 15,000 scientific and government sources. Among a vast number of alarming findings is that the average population size of native species in most habitats on land has fallen by at least 20 per cent, mostly since 1900. **https://www.abc.net.au/news/2019-05-06/biggest-global-assessment-of-biodiversity-sounds-dire-warnings/11082940?fbclid=IwAR3DOKDz_xp0IENuU_B5AhwR3ykIzCqiu8GnnAXbDtTF9W5FFi0hI-yf7PE**

Sydney enterprise working to redress biodiversity crisis

A new UN-backed report has confirmed that that one million species globally are under threat of extinction, as humans clear land and pollute habitats with abandon. Backed by 15,000 scientific and government sources, the report on the planet's failing biodiversity is in part about climate change — but more broadly, about human activity that is breaking down the networks that sustain life. Experts say that there are practical things communities and individuals can do to boost biodiversity, with making greater use of indigenous knowledge and greening our cities high on the list. One enterprise in Sydney's CBD, the Yerrabingin Rooftop Garden, is doing both, providing a beacon of hope amongst the gloom. **https://www.abc.net.au/radio/programs/pm/species-local/11088038**

How is WA tracking in terms of protecting our most at risk species?

A UN report says one million of the world's species are now under threat of extinction. It's a terrifying and bleak global assessment isn't it? This episode of Focus explores how the state is tracking at protecting our local animal and plant species. We look at what West Australians can and are doing in their own backyard to help ensure we protect our biodiversity. **https://www.abc.net.au/radio/perth/programs/focus/biodiversity/11092562**

Woodfordia's 100,000-strong trees a proud symbol of the site's other festival, The Planting

From barren paddock to a flourishing forest, the transformation of the Woodford Folk Festival site in Queensland has been a labour of love for a group of volunteers who call themselves the Woodford Treehuggers. In 1994, the growing folk festival moved from its original home in Maleny to newly purchased land at Woodford. The land was so degraded it was hard to find a shady spot to camp over the hot Christmas-New Year festival period. So volunteers banded together to plant trees. **https://www.abc.net.au/news/2019-05-08/how-volunteers-laid-woodfordias-100000-strong-trees/11072754**

Invasive species are Australia's number-one extinction threat

This week many people across the world stopped and stared as extreme headlines announced that one eighth of the world's species – more than a million – are threatened with extinction. According to the UN report from the Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services (IPBES) which brought this situation to public attention, this startling number is a consequence of five direct causes: changes in land and sea use; direct exploitation of organisms; climate change; pollution; and invasion of alien species. It's the last, invasive species, that threatens Australian animals and plants more than any other single factor. **https://theconversation.com/invasive-species-are-australias-number-one-extinction-threat-116809?fbclid=IwAR1hPNAveQ3F8UAsxkI9AHywp9MrIjVIiS-MsPG4KBAZePcgJxA-tk1gIac**

Cracking Native Seed Germination

Josh is propagating native plants from seeds. You can't collect native seeds from the wild without a licence but they are available to buy online. Some species become dormant so they survive until the conditions are right for them to germinate. Josh shows us a few ways to wake up the seeds from dormancy. **https://www.abc.net.au/gardening/cracking-native-seed-germination/11098010**

Native Bee Buzz

Josh is in Perth's Kings Park where the native plants attract native bees. Kit Prendergast is a native bee researcher. She says that when people talk about bees, they usually mean European honeybees and forget the 2000 bee species that are native to Australia. Native bees are really important for Australia's native flowers because they have co-evolved together over millions of years, so are perfectly suited to pollinating local plants...Kit has been installing bee hotels in gardens and parks as part of her PhD. In one there are four holes occupied by one of the *Megachile* species of bees that cap their nests with resin that is collected from trees. **https://www.abc.net.au/gardening/native-bee-buzz/11115620**

New tech helps the plants talk back

There is nothing new about talking to plants – people have been doing it for at least 150 years to get them to grow faster – but you don't get an instant reply and you could never call it a watertight gardening strategy. But what if a plant could give you immediate feedback on how it was faring? Imagine if a tree could tell you the moment it was getting thirsty or let you know how it was handling a hot spell or a cloudy patch? Two months ago, Dr Melissa Neave, a senior lecturer in sustainability and urban planning at RMIT, and Dr Scott Rayburg, a senior lecturer in water, environment and sustainability at Swinburne, embarked on a project that allows trees to do just that.
https://www.smh.com.au/environment/conservation/new-tech-helps-the-plants-talk-back-20190517-p51okp.html

'Revenues not restoration': Scientists warn NSW tree-planting scheme does more harm than good

There are fears national parks in NSW are being damaged by a revenue-making tree-planting scheme, after revegetation works were carried about in the Capertee National Park. About three hours' drive west of Sydney, Capertee National Park was a working cattle property until 2010, when it was purchased by the State Government and turned into a protected area. But because of overgrazing, the National Park and Wildlife Service (NPWS) ordered habitat restoration works there.
https://www.abc.net.au/news/2019-05-26/capertree-national-park-tree-planting-too-close-experts-warn/11147058

Instagram weddings blamed for popularity of pampas grass, a noxious weed

Biosecurity officers have raided florists on the north coast of New South Wales to seize an illegal noxious weed popularised by so-called Instagram weddings. Pampas grass is native to South America and is considered a weed in most Australian states and territories as it competes with native vegetation and is a fire hazard. It is a highly invasive plant, with each flower head producing up to 100,000 seeds that can spread to a 25-kilometre radius, and is banned from sale in the Greater Sydney, Hunter, south-east and north coast regions of NSW. **https://www.abc.net.au/news/2019-05-29/illegal-untreated-pampas-grass-wedding-trend-on-instagram/11143398**

The science of propagation

Over the last two years horticulturists at the Australian Botanic Garden Mount Annan Nursery have dramatically increased the number of threatened species they are propagating, growing and returning back into the wild. These plants cover a broad spectrum of species including 647 that were identified as threatened in NSW from the last State of the Environment Report in 2015. Meeting this demand requires equal scientific and horticultural practice if conservation efforts through translocation are to be successful.
https://www.rbgsyd.nsw.gov.au/Stories/2019/The-science-of-propagation?fbclid=IwAR1aZWNsWaPl7dyhYBkjAle9cSEXeaE-tl6GMcPgqc6LitcRmDJ0VPl5vTo

The Extremely Rare, Julian's Hibbertia - Envirotube - Ep #1

Find out all about the critically endangered *Hibbertia spanantha* from Ecologist, ANPC Committee member and PhD candidate Chantelle Doyle in this Episode 1 on Ku-ring-gai Council's Envirotube video channel.
https://www.youtube.com/watch?v=haQzeEzl7ng&fbclid=IwAR1cWHIDZjZkpwin0hTr-sbbazZt9Btpm-o8fRwGldwBJYn6VJtskBJqQ6E

Julian's Hibbertia - extremely rare - Envirotube - Ep #2

In this 2nd episode, find out more on the Critically Endangered *Hibbertia spanantha* from ANPC Committee member Chantelle Doyle, and the Hornsby Council nursery team on the problems propagating this incredibly rare plant species.
https://www.youtube.com/watch?v=_EBTYE7ziB0&fbclid=IwAR0CD5PMYSkEF8mNlIl93MqBBRyktU-NieuX2iqA_ycLN91avViN030Wwwg

Lantana removal expert warns spread of the poisonous weed is a 'catastrophe' for Australia

A lantana-removal expert claims the spread of the poisonous weed is a "catastrophe" on a scale that has not been properly recognised or resourced. Introduced to Australia in 1841, the garden escapee is a restricted weed of national significance. Creeping lantana is toxic to stock and forms dense, impenetrable thickets that smother native bushland and pasture, affecting more than 1,400 native species. Biosecurity Queensland estimated lantana had infested 5 million hectares of coastal and hinterland areas of Queensland and New South Wales – an area just 1.8 million hectares shy of the whole landmass of Tasmania.
https://www.abc.net.au/news/rural/2019-06-10/poisonous-lantana-weed-a-catastrophe-removal-expert-warns/11190098

Mangrove tree on cattle property carbon dated as more than 700 years old

The expression "farmers are the original environmentalists" gets thrown around a lot in regional Queensland. The expression refers to the ecological management skills those working the land have and how if they mistreat it, they are putting themselves out of a job. Queensland cattle farmer Lindsay Titmarsh proves that behind every saying there is some truth. From the homestead you look over vast scrubland and mangrove forest across the Mary River estuary towards the world's largest sand island K'gari (Fraser Island), which translates from the Indigenous Butchulla language as "paradise". But of the thousands of trees on Tandora Station, a certain grey mangrove, or *Avicennia marina*, caught Mr Titmarsh's eye and he instantly knew there was something special about it. **https://www.abc.net.au/news/2019-06-11/carbon-dating-reveals-mangrove-to-be-more-than-700-years-old/11193386?pfmredir=sm**

Undocumented plant extinctions are a big problem in Australia – here's why they go unnoticed

A recent survey on the world's plants found a shocking number have gone extinct – 571 since 1750. And this is likely to be a stark underestimate. Not all plants have been discovered, so it's likely other plants have gone extinct before researchers know they're at risk, or even know they exist. In Australia, the situation is just as dire. The Threatened Species Recovery Hub recently conducted two evaluations that aren't yet published of extinct plants in Australia. They found 38 have been lost over the last 170 years, such as the Daintree River banana (*Musa fitzalanii*) and the fringed spider-orchid (*Caladenia thysanochila*). **https://theconversation.com/undocumented-plant-extinctions-are-a-big-problem-in-australia-heres-why-they-go-unnoticed-118607**

Wollemi Pine genome project asks whether the endangered tree can survive the modern world

Hidden in a top secret location within a national park near Sydney, are some of the rarest trees on earth — so rare that anyone found putting them at risk can be handed huge fines, or jailed. The severe safeguards are for good reason — the Wollemi Pine, a tree which outlived the dinosaurs, is so critically endangered that the wild population could be wiped out by disease in an instant. But a new research project is aiming to unlock the secrets of the ancient species, by mapping its genome for the first time. **https://www.abc.net.au/news/2019-06-16/wollemi-pine-critically-endangered-genome-mapping-project/11211294**

Working with Traditional Owners to monitor mangrove health

Working with Tropical Water Quality Hub researchers, Bundaberg-based indigenous ranger group Gidarjil Development Corporation has built its capacity to monitor and manage the health of mangrove ecosystems within the Port Curtis Coral Coast's Traditional Use of Marine Resources Agreement (TUMRA) area, surveying hundreds of kilometres of coastline in the process. **https://nesptropical.edu.au/index.php/2019/06/20/working-with-traditional-owners-to-monitor-mangrove-health/**

NSW audit calls for improved biosecurity responses

An audit report looking at NSW biosecurity responses and compliance released this week reveals that NSW Department of Primary Industries (DPI) has been found wanting. "NSW DPI needs to lift its game in how the department leads the state's biosecurity system," said Invasive Species Council CEO, Andrew Cox. The NSW Audit Office review assessed the effectiveness and cost of DPI's biosecurity emergency response and prevention work. DPI's compliance program is a key prevention activity. The NSW Auditor-General made six key findings and six recommendations. **https://mailchi.mp/invasives/horse-numbers-1562253?e=cfc3e2bfac**

Ludlow tuart forest at heart of campaign rebuilding once-great WA ecosystem

Evelyn Taylor stands in silence as she strains her neck, attempting to see the very tips of a 600-year-old tuart tree. The tree's branches stretch out for metres and are a mighty sight among its much younger siblings. For decades, timber workers strode through this forest searching for smaller and easier tuarts to cut down and harvest. But Mrs Taylor is here for a much different purpose — she is determined to save this tree, and the forest it calls home. The tuart is unique to Western Australia and only grows along a small strip of the state's coastline. This forest once spanned more than 110,000 hectares, from North Perth to south of Busselton. But after many years of clearing for farming, urbanisation and logging, only 3,500 hectares remain near Ludlow in the South West. **https://www.abc.net.au/news/2019-06-23/campaign-to-restore-ludlow-tuart-forest/11235668**

Back to the Bone botanical garden at Watsonville unearths hidden gems of ecological wisdom

Steve and Marijke Hancock reckon they've planted 4750 trees on their block at Watsonville, on the Atherton Tableland, of far north Queensland. The growth rate of each of them is meticulously recorded to demonstrate 'what is possible' planting a habitat for tree kangaroos as well as growing food, timber and pharmaceuticals plants. Even dead trees are left standing to remind visitors to the Back to the Bone botanical garden what can – and cannot – grow in the local environment.
https://www.abc.net.au/radio/programs/qld-country-hour/back-to-the-bone-botanical-garden-unearths-ecological-gems/11248180

Endangered Seeds

Some school kids are working with scientists to save Australia's endangered plants by harvesting their seeds.
https://www.abc.net.au/btn/classroom/endangered-seeds/11229492

Fire, disease, people: the native plants facing extinction – in pictures

Humans are devastating the world's plants and causing a "frightening" number of extinctions, according to a global scientific survey of the issue. This is certainly the case in Australia, where plants make up 72% of the total threatened species list, with 1,308 listed species, and 370 species listed as critically endangered or endangered at a state level. This accelerating decline in the world's biodiversity will have grave consequences for human society, according to the UN's recent global assessment report. In Australia, recent research by the Threatened Species Recovery Hub listed the 100 plants that are most at risk. Dr Jennifer Silcock from the University of Queensland said the list, published in the Australian Journal of Botany, showed the main threats were urbanisation, inappropriate fire regimes, introduced plant disease and habitat loss.
https://www.theguardian.com/environment/ng-interactive/2019/jun/25/fire-disease-people-the-native-plants-facing-extinction-in-pictures

Managing native vegetation

The clearing of native vegetation on rural land is not effectively regulated and managed according to a report released today by the Auditor-General for New South Wales, Margaret Crawford. The processes supporting the regulatory framework are weak and there is no evidence-based assurance that clearing of native vegetation is carried out in accordance with approvals. The report examined how Local Land Services and the Office of Environment and Heritage regulate and manage the clearing of native vegetation in rural areas following legislative reforms introduced in August 2017. It also examined the progress of the Biodiversity Conservation Trust in implementing the Biodiversity Conservation Investment Strategy as a counterbalance to land clearing. The report found that unexplained land clearing can take over two years to identify and analyse, making it difficult to minimise environmental harm or gather evidence to prosecute. Despite around 1,000 instances of unexplained clearing, over 500 reports to the environmental hotline each year and around 300 investigations in progress at any one time, there are few prosecutions, remediation orders and penalty notices for unlawful clearing.
https://www.audit.nsw.gov.au/media/managing-native-vegetation

Audit Office blasts land-clearing rules as 'weak', enforcement 'rare'

The NSW Audit Office has issued a scathing assessment of the Berejiklian government's reform of the native vegetation laws, finding land-clearing was "not effectively regulated" with "few tangible outcomes" for breaches. In a report released on Thursday, the agency also found almost two years after the laws came into effect, there is no timetable for the release of native vegetation regulatory maps for the two largest categories making it difficult for landholders "to determine if their plans for clearing are lawful". It noted that over 200,000 hectares - or about 700 times the size of Sydney's CBD - had been approved for thinning or clearing of native vegetation in the first 18 months of the codes being introduced in August 2017. However, the auditors found "there is no evidence-based assurance that clearing of native vegetation is being carried out in accordance with approvals".
https://www.smh.com.au/environment/conservation/audit-office-blasts-land-clearing-rules-as-weak-enforcement-rare-20190627-p521tl.html

Threatened species panel should include agriculture sector: report

The federal government should take advice from the agriculture sector when deciding on protections for threatened animals and plants, says an official report that recommends spending $1 billion encouraging farmers and others to protect the environment. Environment Minister Sussan Ley welcomed the findings on Thursday, saying it was "the right time to have a conversation"

about how farming, business and environmental interests could be brought together. Many in the agriculture sector say Australia's central piece of environment law, the Environment Protection and Biodiversity Conservation Act, is too complicated and unfairly restricts farming activities. However, conservationists say land clearing for agriculture is a key factor in the increasing number of threatened species and critical habitats must be protected.
https://www.smh.com.au/politics/federal/threatened-species-panel-should-include-agriculture-sector-report-20190627-p521vr.html

Backyard Biodiversity

Josh gets a visit from an ecologist, Mandy Bamford, to see how biodiverse his backyard really is and offer some tips for home gardeners wanting to share their space with more native flora and fauna.
https://www.abc.net.au/gardening/backyard-biodiversity/11252044

White cedar is a rare bird: a winter deciduous Australian tree

White cedar (*Melia azedarach*) grows naturally across Queensland and northern New South Wales, but is widely planted as an ornamental tree all over Australia. It also grows across much of Asia, and belongs to the mahogany family.
https://theconversation.com/white-cedar-is-a-rare-bird-a-winter-deciduous-australian-tree-118837

Research findings factsheet: Conserving brigalow flora

Research on Australia's most imperilled plants has developed a new method to identify species at risk based on museum records, strength of habitat associations and vegetation mapping. The method has been applied to brigalow forest, which once occupied 14 million hectares of fertile plains in Queensland and New South Wales. Due to extensive clearing for pasture and crops since the 1950s, only 8 per cent of the original forest remains, and large areas of the remainder are heavily degraded by exotic grasses. The research findings have identified two species of bush tomatoes that are eligible as Critically Endangered using Red Listing criteria. The method could be applied to identify species that would be threatened by habitat loss of future areas targeted for clearing.
http://www.nespthreatenedspecies.edu.au/_images/News/2.4%20brigalow%20flora%20findings%20factsheet_F.pdf

Norfolk Island's threatened flora

The native forest on Norfolk Island provides vital habitat for the island's threatened plant and bird species, many of which are found nowhere else on the planet (also called endemic). When the British colonised Norfolk Island in 1788, they cleared much of the original vegetation. Remaining forest is now protected in the national park and reserves, but plant recruitment is poor and invasive non-native plant species would likely overtake the forest without the on-going efforts of park managers.
http://www.nespthreatenedspecies.edu.au/news/norfolk-island-s-threatened-flora

Biodiversity Across the Borders Conference at Federation University puts climate change in spotlight

Conservation and climate change will be in the spotlight at Federation University on Friday at one of Australasia's leading biodiversity and ecology events. More than 600 conservation experts, local council representatives and school teachers will attend the Biodiversity Across the Borders Conference at the Mount Helen campus. Conference organiser Professor of Environmental Management Singarayer Florentine said the conference was timely given the recent release of a United Nations report predicting massive species extinctions.
https://www.thecourier.com.au/story/6213028/why-researchers-want-you-to-care-about-the-conservation-of-biodiversity/

Biodiversity Across the Borders Conference confronts depressing reality of climate change

Climate scientists speaking at a leading biodiversity conference in Ballarat on Friday warned their presentations would be depressing. Their speeches began with details of the impacts of climate change including photos of dead animals and habitat destruction. Presenters told of devastating coral bleaching, mass mortality of mangroves, saltwater intrusion into freshwater wetlands, depletion of snow cover, coastal erosion, penetration of wildfires into rainforests, and the world's first climate change-related mammalian extinction seen in just the past few years.
https://www.thecourier.com.au/story/6218208/biodiversity-conference-highlights-need-for-urgent-conservation-action/

First ever Victorian sighting of rare plant

For the first time ever the rare *Pomaderris viridis* plant, a slender shrub that grows up to five metres high, has been found in Victoria. The plant, which looks a little similar to Dogwood or Native Hazel, is more often found in NSW - but even there it is rare. Despite extensive searching only one specimen has been found so far. **https://www.forestsandreserves.vic.gov.au/media-releases/first-ever-victorian-sighting-of-rare-plant?fbclid=IwAR0e0_9nRgAQUAUfe717f9rGSpRHILfAYJZ3wr6VX1K7WvSpA2nnYU0CuWE**

Why are England's roadsides blooming?

A long-running campaign encouraging councils to let neatly-mown grass verges become mini meadows where wildflowers and wildlife can flourish appears to be building up a head of steam. Since 2013, Plantlife has been telling authorities the move could help them save money and boost their green credentials. Several have taken the message on board. **https://www.bbc.com/news/uk-england-48772448?fbclid=IwAR2zHZaXtE9xWuZ00IY6RY4-y7sxwqWmWcsfkYKcqXN2PGRfhEb_Aii9UPY**

High-value opportunities exist to restore tropical rainforests around the world - here's how we mapped them

The green belt of tropical rainforests that covers equatorial regions of the Americas, Africa, Indonesia and Southeast Asia is turning brown. Since 1990, Indonesia has lost 50% of its original forest, the Amazon 30% and Central Africa 14%. Fires, logging, hunting, road building and fragmentation have heavily damaged more than 30% of those that remain. Replenishing them is an urgent global imperative. A newly published study in the journal Science by European authors finds that there is room for an extra 3.4 million square miles (0.9 billion hectares) of canopy cover around the world, and that replenishing tree cover at this full potential would contribute significantly to reducing the risk of harmful climate change. **https://theconversation.com/high-value-opportunities-exist-to-restore-tropical-rainforests-around-the-world-heres-how-we-mapped-them-119508?fbclid=IwAR2vbwSjhe2rQ1Ha9eu5nyLQsJjN69R5Rsp_tAEWX4h7bO6Kfs7nwlrclas**

Seed bank saving species in Western Australia

Threatened plant scientist Leonie Monks is on the front line of saving species in Western Australia. Get a glimpse of what happens behind the scenes at the Western Australian Seed Centre and research to support the reintroduction of threatened plant species back into the wild. **https://www.facebook.com/nespthreatenedspecies/videos/440139453208791/UzpfSTQ4NzE5NzAyNDY0MzQ5MToyNzc0MzgzNzcyNTkxNDYw/**

Climate change could be paused by planting trees, researchers say, as they map out available land

Planting trees to reduce the amount of carbon dioxide in the atmosphere seems like a no-brainer in the fight against climate change. But until recently it's not been clear how much land we'd need to make a tangible difference to warming, and whether we'd need to reclaim farm and residential land to do it. Now new research published today in Science estimates there's enough suitable unused land on the globe for reforestation to store around 205 gigatonnes of carbon. That's enough to buy us about 20 years in the fight against climate change, according to researcher Jean-Francois Bastin from the Institute of Integrative Biology in Zurich. "This would definitely help to keep us at that maximum of 1.5 degrees by 2050," Dr Bastin said. **https://www.abc.net.au/news/science/2019-07-05/climate-change-tree-planting-carbon-dioxide/11267556**

Northern Territory gardeners using native plants to fight animal extinction

Alan Smith and Christine De Chambord begin every day by taking in the sights and sounds of their Alice Springs garden. It is a busy place: throughout the day they see babblers, native doves, honeyeaters, galahs, finches, parrots, butcher birds and kingfishers. Ten years ago, when a tree dominating their backyard fell over and needed to be removed, they began again and today their backyard is full of native plants and local birdlife. But Mr Smith said it was not always that way. "We planted native plants … but we realised that … plants that are native to Australia probably aren't going to survive in Alice Springs," he said. "A lot of them died. They just weren't up to the tough conditions here. So we look for plants now that are native to the region." **https://www.abc.net.au/news/2019-07-06/gardeners-using-native-plants-to-fight-animal-extinction/11284982?pfmredir=sm&fbclid=IwAR0E5IWt-8I5TC7S9lzJSH46C9A8MjHOmdCnJan3B685zz2XlGjGjWO3iX8**

Drought and climate change blamed for the death of centuries-old sandalwood trees

Rare Australian sandalwood trees that are more than 200 years old are dying in South Australia's outback. Ecologist John Read spotted the dying trees on his property at Secret Rocks, between Whyalla and Kimba, on the state's Eyre Peninsula. The trees had been seen by the explorer Edward John Eyre in 1840. "We probably walked past a dozen of these big old mature sandalwoods near our house and at least seven of them were dead and the others looked really stressed," Mr Read said. "We've sort of controlled kangaroo and rabbit numbers to help them regenerate, and they've been doing pretty well over recent years, but in the last three or four months, we've noticed a lot of them are dying." Sandalwoods are a threatened plant species because they are harvested extensively to make incense and other aromatherapy products.
https://www.abc.net.au/news/2019-07-07/centuries-old-australian-native-trees-dying/11282364

Feral deer destroying a lifetime of bushcare conservation

The first raid seemed inconsequential, a young buck with a couple of does appeared in forest overlooking Stanwell Park Beach in NSW and unleashed a bit of damage on the local bushland. At the time it wasn't enough to cause too much concern for Kieran Tapsell, a local resident who had spent years ridding the area of invasive weeds such as lantana and cassia, and restoring the land with indigenous trees and shrubs. Over ten years he had planted 800 native species, mostly rainforest trees.
https://invasives.org.au/blog/feral-deer-stanwell-park/

Cape York community's fight to save Iron Range rainforest devastated by Cyclone Trevor

Driving into the Kutini-Payamu National Park near Lockhart River in Queensland's Cape York, it is hard to imagine it was created to preserve the Iron Range rainforest.

The sides of the road are lined with piles of trees, some of them at least a metre in diameter and the sound of birds chirping is almost non-existent. It is a stark contrast to the area described as vital habitat to animals like the cassowary, cuscus, eclectus parrot, palm cockatoo and the green tree python. Cyclone Trevor swept through the area in March, leaving an unprecedented trail of destruction.
https://www.abc.net.au/news/2019-07-13/iron-range-national-park-cyclone-recovery-to-take-decades/11282936

Botanists rediscover extinct ferns on remote Queensland mountaintops

Two tiny ferns presumed to be extinct for over half a century have been rediscovered by botanists on two remote mountaintops in north Queensland's Daintree rainforest. The enigmatic filmy fern *Hymenophyllum whitei* was only known by a single collection in 1931 by Cyril White from Thornton Peak, which rises above the Daintree Rainforest to a height of 1374 metres. Botanist from the Royal Botanic Garden Sydney Dr Matt Renner was a part of an expedition with the Australian Tropical Herbarium tasked with trying to find the ferns. "*Hymenophyllum whitei* is extremely hard to spot as its fronds are only three centimetres long and when dry they actively hide by curling up and retreating into surrounding mosses and liverworts" said Dr Renner.
https://www.rbgsyd.nsw.gov.au/Stories/2019/Botanists-rediscover-extinct-ferns-on-remote-Queen?fbclid=IwAR1AFxfdY1ccHMx8AvvocXpLewxIoRC79U3GlmsgPjQUsfrcKjtD2ORbF4M

Old-growth forests logged, as tree planting in Sydney accelerates

Plans by the NSW Government to strip protection from old-growth forests in the state's north-east will cause the loss of as many as 70,000 key habitat trees, the independent Natural Resources Commission estimates. The expected tree loss follows a decision last year to overhaul rules for coastal forestry that increased loggers' access to timber previously off limits. The remapping and rezoning affects 14,600 hectares in the north-east alone in the initial phase and potentially five times eventually. The threat to native forests comes as Planning Minister Rob Stokes revealed the Berejiklian government had planted 154,000 trees since April 2018 when it announced its "stretch goal" of planting 5 million trees in greater Sydney by 2030.
https://www.smh.com.au/environment/conservation/old-growth-forests-logged-as-tree-planting-in-sydney-accelerates-20190725-p52asl.html

'I'm seeing it disappear before my eyes': crisis point in Australia's wet tropics

Last summer, in November, Queensland biologist Professor Stephen Williams was at a workshop in Vietnam when he received an urgent email from home. It was from a ranger he knew who worked for the World Heritage-listed wet tropics area around Cairns. Something unprecedented was happening at the top of Mount Bartle Frere, North Queensland's highest peak. At 1611 metres high, the mountain's upper reaches are in what is meant to be a cool temperate zone. But instead of normal summer readings at the peak, which rarely top 25, temperatures had soared past 35 degrees for six days in a row, culminating in one scorcher of 39.
https://www.smh.com.au/environment/climate-change/i-m-seeing-it-disappear-before-my-eyes-crisis-point-in-australia-s-wet-tropics-20190726-p52azh.html

Other conferences, courses and events

Updates available at:
http://anpc.asn.au/other_conferences_and_events

ESA19: the 2019 Conference of the Ecological Society of Australia - Launceston TAS, 24-29 November 2019

'Ecology: science for practical solutions'. Ecology is the science of interactions among all forms of life and the abiotic environment they inhabit, and in turn, change and shape. Applications of ecology are all around us everyday, in natural resource management, forestry, fisheries, agriculture, water production and conservation biology. These applications demonstrate the importance of ecology in seeking to understand and explain our Earth, and how humans can better co-exist with nature in an increasingly anthropogenically-modified environment. This provides the theme for this conference: how the science of ecology can contribute to developing and implementing solutions for our planet in the throes of a biodiversity crisis and a changing climate. Ecological science is fundamental to informing policy but the next generation of practising ecologists will need to work more closely with economists, political scientists, historians, human geographers and social scientists to develop ecologically sustainable practices.
https://www.esa2019.org.au/

ASBS–NZPCN 2019 - Wellington NZ, 24-28 November 2019

'Taxonomy for Plant Conservation'. We invite you to a joint conference of the Australasian Systematic Botany Society and the New Zealand Plant Conservation Network—an exciting opportunity to connect with people who are passionate about science and conservation of native plants in New Zealand and Australia. The conference will be held at Wellington's premier conference venue, the Museum of New Zealand Te Papa Tongarewa. Get up to date information from our stimulating and comprehensive range of speaker presentations. Explore Wellington's forests and rugged coastlines on our field trips. Network with people involved in a wide variety of plant conservation work. Discuss and learn at our workshops. Take a tour of the Te Papa Herbarium (WELT) and Otari Native Botanic Gardens.
https://systematics.ourplants.org/

SAVE THE DATE: NSW Nature Conservation Council's 2020 Bushfire Conference - Sydney NSW, 19-21 May 2020

More information about the conference will become available closer to the date. Venue: NSW Teachers Federation Conference Centre, Surry Hills, Sydney This multi-disciplinary fire management conference centres on themes of fire regimes, fire thresholds and species responses, and managing fire for different objectives including cultural, ecological and hazard reduction burning in a changing climate.
https://www.nature.org.au/healthy-ecosystems/bushfire-program/

Research round up

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